# TAXONOMY AND ECOLOGICAL NOTES OF SOME OSTRACODS FROM AUSTRALIAN INLAND WATERS

by P. DE DECKKER*

## Summary

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Two new ostracod genera *Alboa* and *Gomphodella* are described and 11 new species: *A. woroоa*, *Bennelongia barangaroo*, *B. pinpi*, *B. nimala*, *Australocypris dispar*, *Strandesia phoenix*, *Reticypris clava*, *R. kurdimurka*, *Ilyocypris perigundi*, *Leptocythere lacustris*, and *Gomphodella maia*. Ecological notes are presented for these and an additional eight species, some of which are re-described.

## Introduction

Ostracods are common inhabitants of most types of waterbodies in Australia with the halobiont fauna being particularly diverse here compared to other parts of the world (De Deckker 1981). However, taxonomic knowledge of Australian ostracods is incomplete, as indicated by the numerous ostracods referred to in open nomenclature in publications dealing with limnological surveys. The present paper sets out to describe some of the common ostracod species found in inland waters by providing many illustrations of their shell to simplify further identifications.

The specimens used for the descriptions here are deposited at the South Australian Museum.

## Systematic descriptions

SUBCLASS: OSTRACODA Latreille, 1806
ORDER: PODOCOPIDA Müller, 1894
SUPERFAMILY: CYPRIDACEA Baird, 1845
FAMILY: CYPRIDIDAE Baird, 1845
SUBFAMILY: CYPRINOTINAE
Bronstein, 1947

### **Alboa** n.gen.

*Type species: Alboa woroоa* n.sp., gender masculine.

*Diagnosis:* Asymmetrical valves: in anterior view, greatest width of right valve at 0.5 from dorsum and of left value at 0.7 from dorsum. Selvage prominent in left valve and placed at 0.5 of width of inner lamella anteriorly. Peripheral groove on the outside of selvage in left valve.

Male maxillar palps strongly asymmetrical; lateral lobe and distal part of copulatory sheath boot-shaped. Geniculate joint between 1st and 2nd thorocopoda I segments with two unequal setae.

*Derivation of name: Alboa* meaning egg in aboriginal language to refer to the egg-shaped shell.[1]

### **Alboa woroоa** n.sp.

FIGS 1–2

1919 Cypris sydneia King: Chapman, p. 27.

*Diagnosis:* As for genus.

*Description: Carapace* (External). Pseudopunctate, oval-shaped with ventral area almost flat except in mouth area which is slightly concave at about 0.4 from anterior. In left valve, other faint concavity, anterior to mouth region at about 0.2 from anterior. Greatest height and width at about middle. Left valve larger and overlapping right one anteriorly, posteriorly and ventrally. In anterior view, valves strongly asymmetrical; left valve, broader and larger; greatest width of left valve at 0.7 from dorsum and of right value at 0.5 from dorsum. Carapace pilose with a few long hairs in posterior area. Flange broadest in left valve. Normal pore canals simple and rimmed. (Internal). Inner lamellae broadest anteriorly and ventrally but slightly broader in left valve; posteriorly, inner lamella of right valve very narrow. In left valve, selvage prominent and at about 0.75 of inner lamella's width from outer margin. Selvage follows curvature of shell except anteriorly where it is less curved. Posteriorly, selvage less prominent and at about 0.5 of inner lamella's width. Peripheral narrow depression on outside of selvage. In right valve,

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* Department of Zoology, University of Adelaide. Present address: Department of Biogeography & Geomorphology, Australian National University, P.O. Box 4, Canberra, A.C.T. 2600.

[1] Aboriginal words used in this text are from Papps (1965) and Cooper (1962).

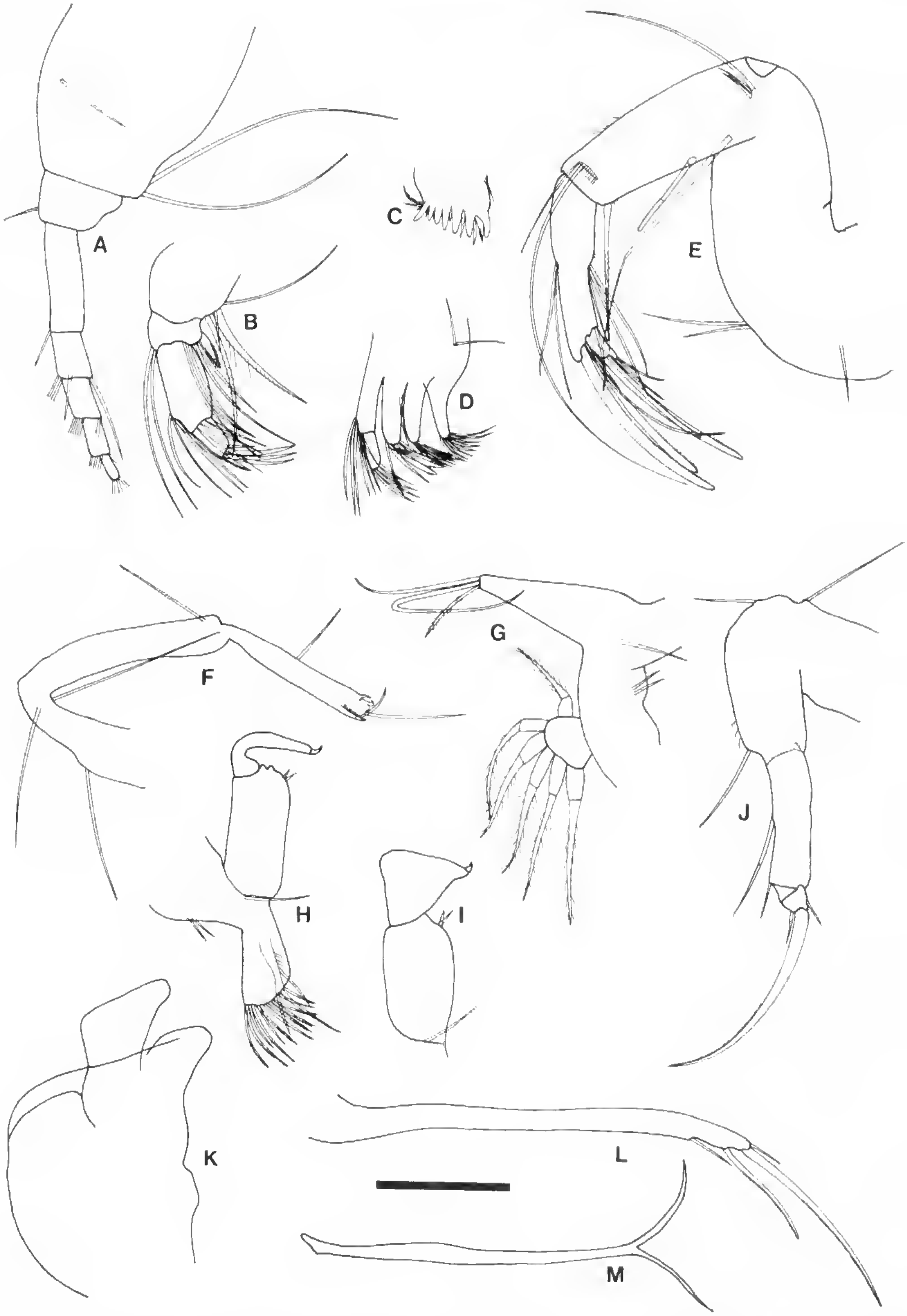

Fig. 1. *Alboa worooa* n.gen., n.sp. a antennula, b mandible—palp, c mandible—coxale, d maxillula, e antenna, f thoracopoda II, g maxilla, female, h maxilla, male, i maxilla—endopodite, male, j thoracopoda I, k hemipenis, l furca, m furcal attachment. a-e, h-m: holotype adult male. g: paratype: adult female. Scale: 100 μ.

selvage peripheral and faint except anteriorly where it is much sharper and extends further than edge of shell. Right valve with faint tubercles posteroventrally along edge of shell. Radial pore canals numerous, narrow and straight. Central muscle field consisting of three scars in front and two behind; upper and lowest scars in front broad and elongated whereas other two almost circular. Mandibular scars below and in front of central muscle field.

*Anatomy.* Antennula: (Fig. 1a) 7-segmented; length-width ratio of last six segments: 2/3, 3/1, 1/1.4, 3/2, 1.75/1, 2.5/1. Most plumose natatory setae as long as all segments together.

Antenna: (Fig. 1e) No obvious sexual dimorphism; three long claws plus a smaller one; natatory setae reaching tip of claws.

Mandible: (Figs 1b,c) Mandibular coxale with seven teeth; last tooth longer than penultimate and near its base externally with three setae of different sizes; longest one pilose. Endopod with α bristle short, narrow and barren; β bristle thick, stout and tufted; γ bristle longer than terminal segment, thick and with short hairs on external side.

Rake-like organ: Six or seven short and stout teeth with an additional bifid one on inner side of each rake.

Maxillula: (Fig. 1d) 3rd lobe with top toothed Zahnborsten; length width ratio of both palps: 3/1.

Maxilla: Sexually dimorphic: in male, palps strongly asymmetrical with right one broader (Figs 1h,i). In female (Fig. 1g) endopod with three plumose setae, longest one in middle and two others of unequal length. In both sexes, epipod with five long plumose Strahlen and one shorter plumose one near base of plate.

Thoracopoda I: (Fig 1j) Penultimate segment weakly divided. Two setae on geniculate joint between 1st and 2nd segment; anterior seta longest.

Thoracopoda II: (Fig. 1f) End of last segment with two unequal setae and terminal pincers.

Hemipenis: (Fig. 1k) Lateral lobe boot-shaped with base rather broad and inner distal end of copulatory sheath of similar shape to lateral lobe.

Zenker organ: Both ends rounded and with 40 rosettes.

Furca: (Fig. 1l) Pectinate claws unequal with posterior claw 0.7 of length of anterior one and anterior seta 0.17 of anterior claw, and shorter than posterior seta.

Furcal attachment: (Fig. 1m) Long and narrow with distal end bifurcate; ventral and dorsal branches of similar width and length.

Eye: Cups of nauplius eye fused; dark brown.

*Colour of shell:* green.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| [2]LV | 1540μ | 880μ | RV | 1460μ | 860μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 1700μ | 1000μ | RV | 1640μ | 980μ |

*Type locality:* Pool on the southern side of Light River, 20 m from the bridge on the Port Wakefield Road, north of Adelaide, S.A. (34°33′09″S, 138°27′20″E).

*Derivation of name:* From the aboriginal language, *woroon* meaning green for the colour of the shell.

*Ecology and distribution: A. woroon* inhabits lakes and temporary pools. This species is found in fresh waters and its highest salinity record is 3.5‰ at the type locality. *A. woroon* has also been recorded from the following localities: roadside pool, 13 km east of Rocky River and Duck Lagoon, both on Kangaroo Island, S.A., and Granite pool at Newmann's Rocks, 140 km east of Norseman, W.A. Additionally, valves of this species have been found in subsurface sediments at Birchmore Lagoon, Kangaroo Island (in those specimens, the asymmetry of the valves is more pronounced with the right valve forming a broader hump dorsally). This species has also been described by Chapman (1919) as *Cypris sydneia* from Pleistocene (*fide* Chapman) sediments from Boneo Swamp near Cape Schanck, Vic.

*Remarks: A. woroon* is related to the *Heterocypris* species as their anatomy is similar, in particular the triangular shape of the right maxillar palp in the male and the boot-shaped lateral lobe of the hemipenis. The asymmetrical valves and the presence of faint tubercles on the edge of the valve are also similar to *Heterocypris* species. The major difference is the pre-

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[2] LV, RV = left valve, right valve. L, H = length, height.

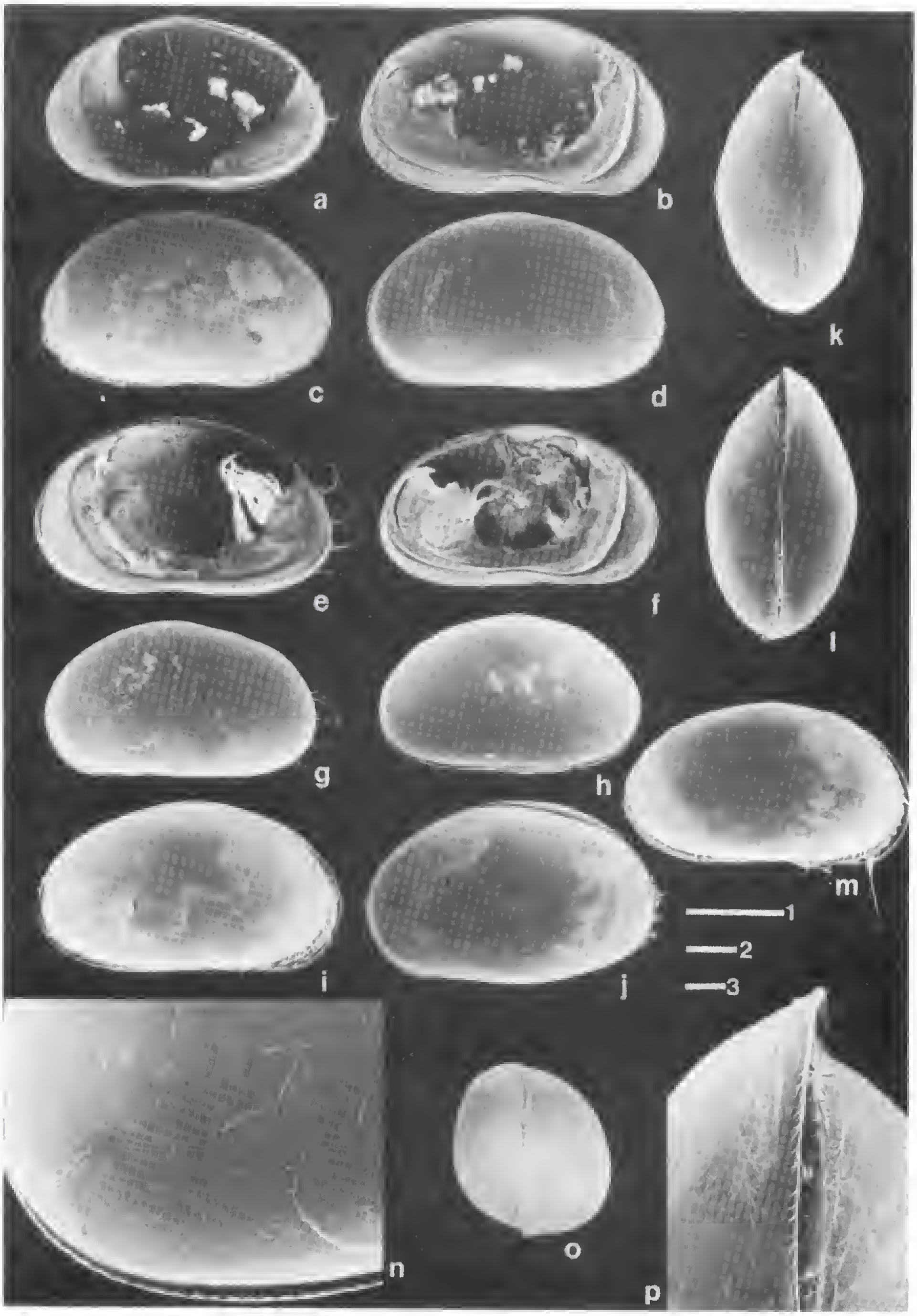

Fig. 2 *Alboa woroa* n.gen., n.sp. a RV internal, female paratype. b LV internal, female paratype. c RV external, female paratype. d LV external, female paratype. e RV internal, male holotype. f LV internal, male holotype. g LV external, male paratype. h RV external, male paratype. i C showing RV, female paratype. j C showing LV, female paratype. k C dorsal, male paratype. l C ventral, male paratype. m C showing RV, male paratype. n C showing RV, posterior detail of h. o C anterior, male paratype. p C dorsal, anterior detail of k. Scale: 1—500$\mu$ for a-m; 2—50$\mu$ for n; 3—50$\mu$ for p. LV, RV = left valve, right valve. C = carapace. All views are lateral ones except when indicated.

sence of a prominent selvage in *A. worooa* not seen in *Heterocypris* species nor in the closely allied species grouped in *Cyprinotus*. This feature of the shell is sufficient to warrant separate generic distinction. Additionally, the right valve of *A. worooa* is not curved outwards in the anterior area compared to *Heterocypris* and *Cyprinotus* species.

### SUBFAMILY: CYPRIDINAE Baird, 1845

### *Bennelongia* De Deckker & McKenzie, 1981

*Type species: Bennelongia harpago* De Deckker & McKenzie, 1981

*Remarks*: *Bennelongia* comprises five Australian species: *B. harpago* De Deckker & McKenzie, 1981, *B. australis, B. barangaroo* n.sp. (= *Chlamydotheca bennelong* (King) *sensu* Sars 1894, 1896), *B. nimala* n.sp., *B. pinpi* n.sp. It is likely that *Strandesia feuerborni* Klie, 1932 and *Strandesia flavescens* Klie, 1932, both described from Indonesia, belong to *Bennelongia*. From the original description and illustrations of the valves (Klie 1932), it appears that these two species are characterized by the asymmetrical valves so typical of *Bennelongia* species. Two specimens resembling *S. feuerborni* have been collected from Cauckingburra Swamp, at Lake Buchanan, S.W. of Charters Towers, Queensland. One specimen is illustrated in Fig. 9r but no further identification has been carried out.

### *Bennelongia australis* (Brady, 1886)

1886 *Chlamydotheca australis* n.sp., Brady, p. 91.

*Diagnosis:* Area just behind the beak-like feature of the left valve strongly concave and outline of hemipenis as in Figs. 6f,j.

*Description: Carapace.* (External) Adult: Pseudopunctate and pilose carapace, oval with flattened ventrum and concave mouth region. Asymmetrical valves: left beak-shaped anteroventrally with deeply concave depression posterior to beak. Right valve almost smoothly curved anteroventrally except for narrow beak-like flange there. This flange overlapped by beak-like anterior area of left valve when carapace closed. In dorsal view, carapace egg-shaped with both valves slightly pinched laterally at about 0.17 from anterior. Simple type normal pore canals. Bordering edge of right valve anteriorly are a number of small quadrate tubercles.

Juvenile: Ellipsoidal to subtriangular in shape; symmetrical valves without beak-like feature, and surface of shell either deeply pitted or coarsely reticulated with large wart-like tubercles present mostly anteriorly and posteriorly. Reticulation especially varied in smallest juveniles with some large sieve-like plates.

(Internal) Adult: Inner lamellae broader anteriorly than posteriorly. In left valve, selvage narrow but distant from inner margin posteriorly and ventrally; anteroventrally inner list forms broad but short lip-like flap which is absent anterodorsally. Deep depression anterodorsally near edge of shell and following curvature of inner margin anteriorly. It is absent in vicinity of lip-like flap. No outer list in left valve. Right valve with selvage peripheral except in anteroventral area where it is slightly broader and further inside inner lamella. Behind mouth region, flange thin but broad, and curves outward to almost reach tubercles. Outer list faint, running parallel to curvature of shell bordered with tubercles in front of mouth region and posteroventrally. Radial pore canals narrow and straight. Central muscle field consists of broad horizontal scar above, two parallel ones below and another broad one behind. Two additional, almost circular scars, one behind middle posterior one and other behind bottom scar. Two broad mandibular scars in front and below.

In juveniles, inner lamellae of similar width all around except in posteroventral area where they are slightly broader. Selvage broad, following curvature of shell and with no lip-like flap. Flange narrow but obvious in both valves and of same width as outer list which runs parallel to curvature of shell. Depression caused by some wart-like tubercles on outside area are seen inside valves.

*Anatomy.* Antennula: (Fig. 6a) Natatory setae as long as all the segments together. Length/width ratios of the terminal six segments are: 1/1, 5/2, 1.8/1, 2/1, 2.3/1, 2/1.[3]

Antenna: (Fig. 6d) Natatory setae extend to tip of claws. Three claws plus shorter one in both sexes; one of additional short and thin claw attached to terminal segment in male is longer and denticulated in female.

Mandible: (Fig. 6b) Mandibular coxale with seven teeth; endopod with long, narrow and barren $\alpha$ bristle, thick, stout and pilose $\beta$ bristle and long pilose $\gamma$ bristle which is twice as long as last segment.

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[3] The ratios of the 6 segments of *B. harpago* have been inverted in the original description.

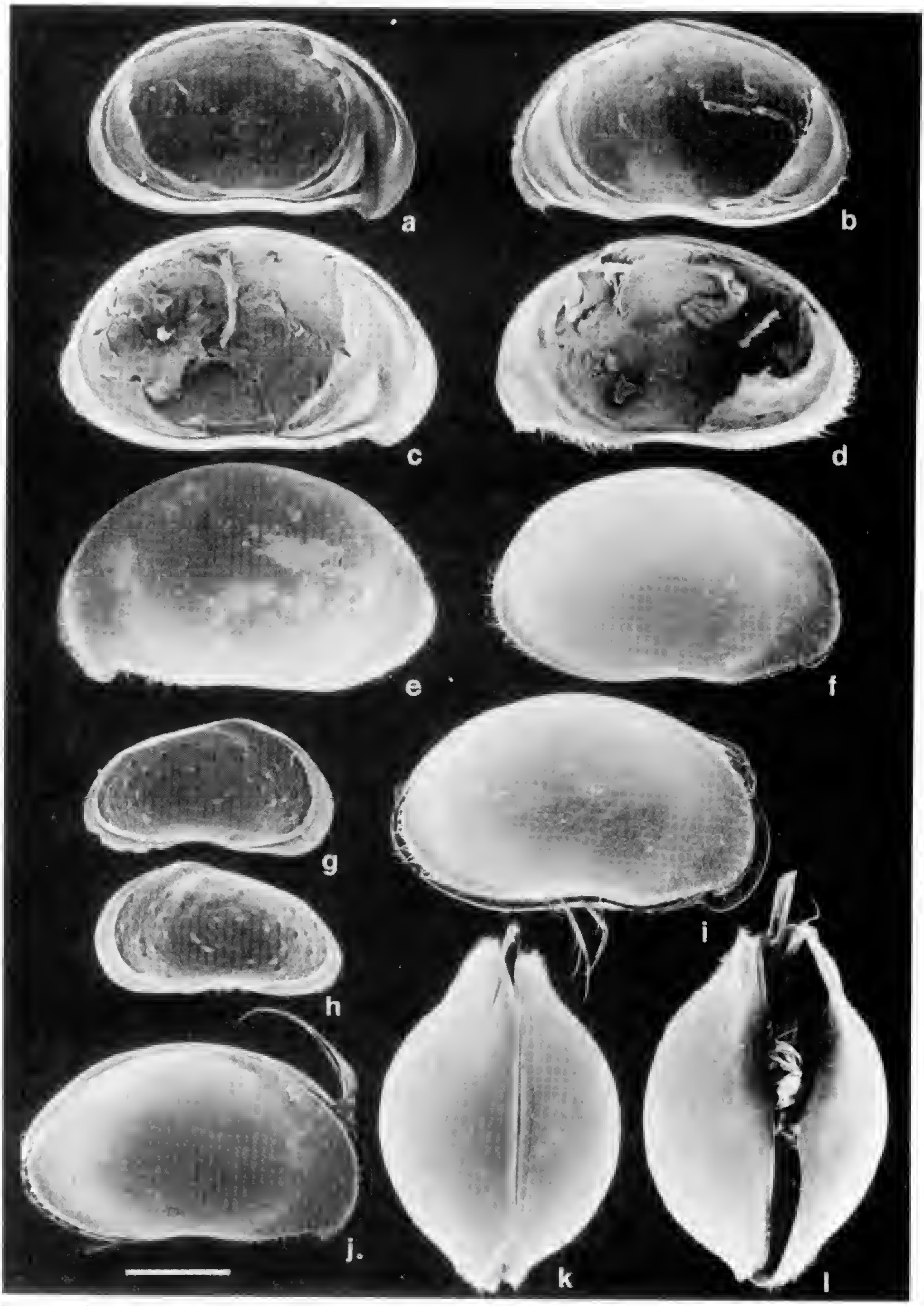

Fig. 3. *Bennelongia australis* (Brady, 1886) n.gen. a LV internal, male. b RV internal, male. c LV internal, female. d RV internal, female. e LV external, female. f RV external, female. g LV internal, juvenile. h RV internal, juvenile. i C showing RV, female. j C showing RV, male. k C dorsal, female. l C ventral, female. a-l: Creek pool flowing across the road, 2 km N of Leonora, W.A. Scale: 500$\mu$.

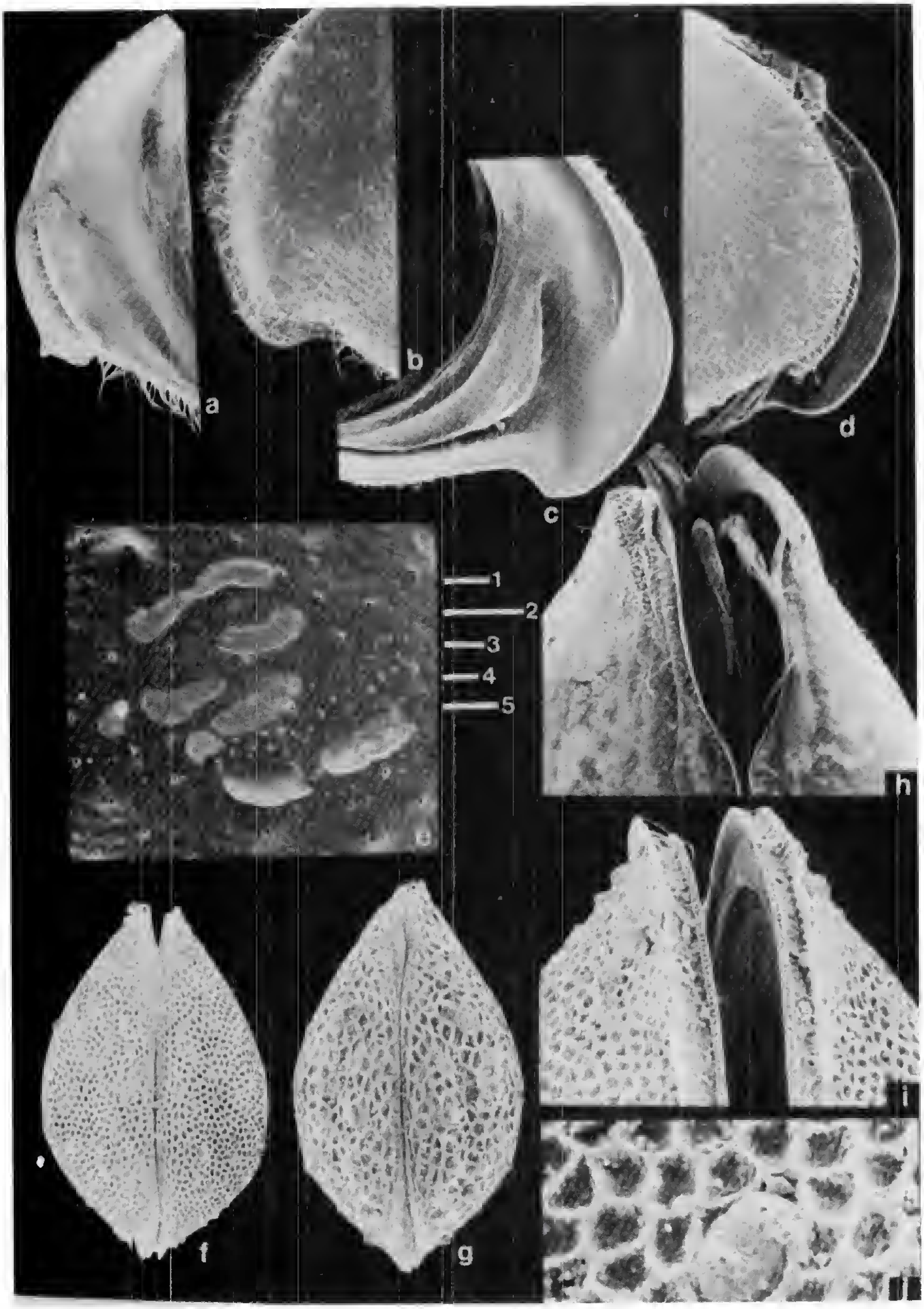

Fig. 4. *Bennelongia australis* (Brady, 1886) a RV internal, detail anterior of Fig. 3d. b LV external, detail anterior of Fig. 3e. c LV internal, detail anterior of Fig. 3a. d C showing RV, detail anterior of Fig. 3i. e LV internal, detail central muscle scar area of Fig. 3g. g C dorsal, enlargement of Fig. 51. h C ventral, detail anterior of Fig. 5k. f C dorsal, enlargement of Fig. 5o, i C ventral, detail anterior of Fig. 3p. j C dorsal, detail of Fig. 4f. a-e: Creek pool flowing across the road, 2 km N of Leonora, W.A. f-j: Roadside pool, 5 km S of Cunderdin, W.A. Scale: 1—100μ for a-d, h; 2—50μ for e; 3—100μ for f; 4—50μ for g; 5—20μ for i.

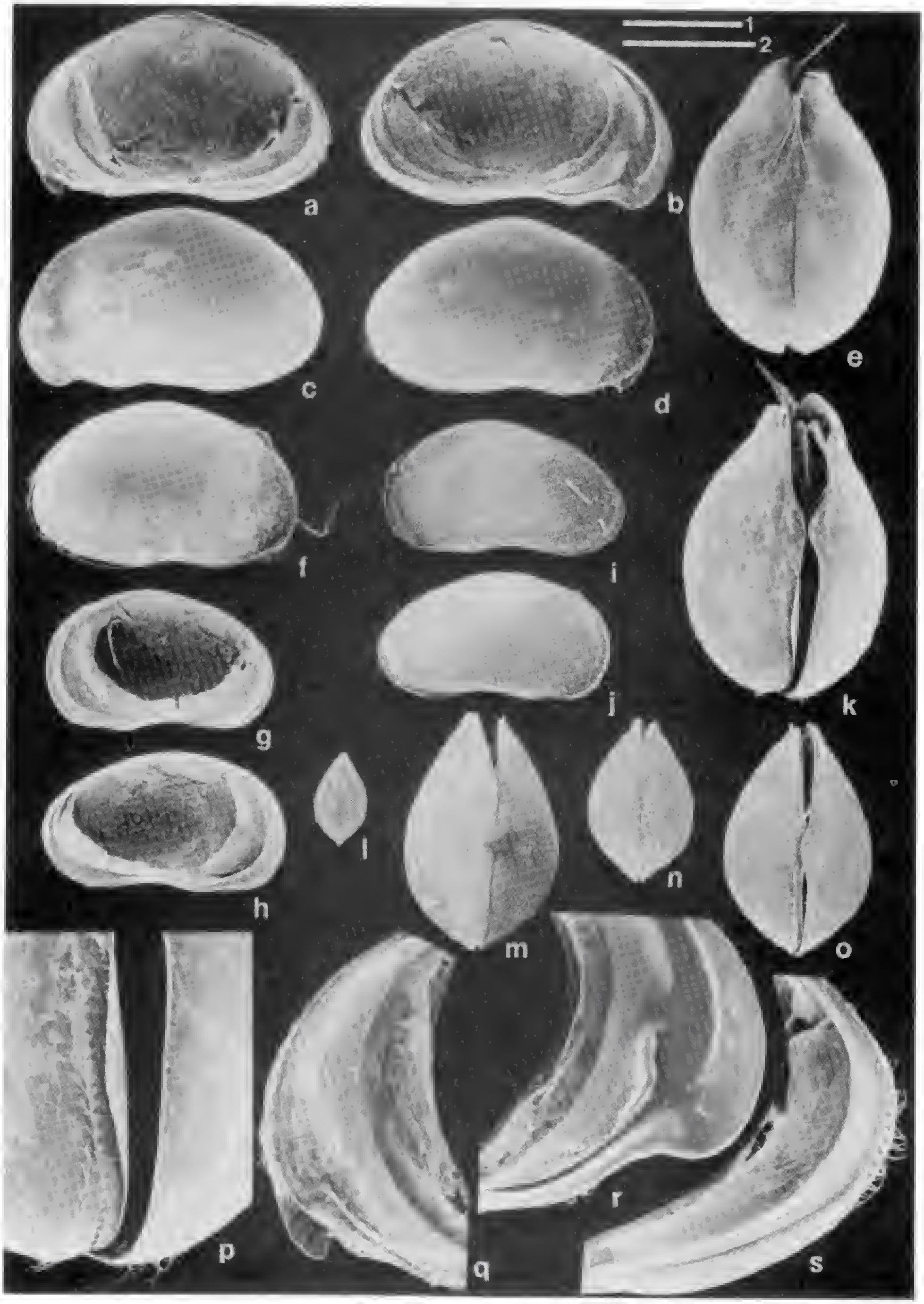

Fig. 5. *Bennelongia australis* (Brady, 1886) a RV internal, female. b LV internal, female. c LV external, female. d RV external, female. e C dorsal, female. f C showing RV, female. g RV internal, juvenile. h LV internal, juvenile. i LV external, juvenile. j RV external, juvenile. k C ventral, female. l C dorsal, juvenile. m C dorsal, juvenile. n C dorsal, juvenile. o C ventral, juvenile. p C ventral, detail posterior of k. q RV internal, detail anterior of a. r LV internal, detail anterior of b. s RV internal, detail posterior of a. a-s: Roadside pool, 5 km S of Cunderdin, W.A. Scale: 1—250μ for a-o; 2—100μ for p-s.

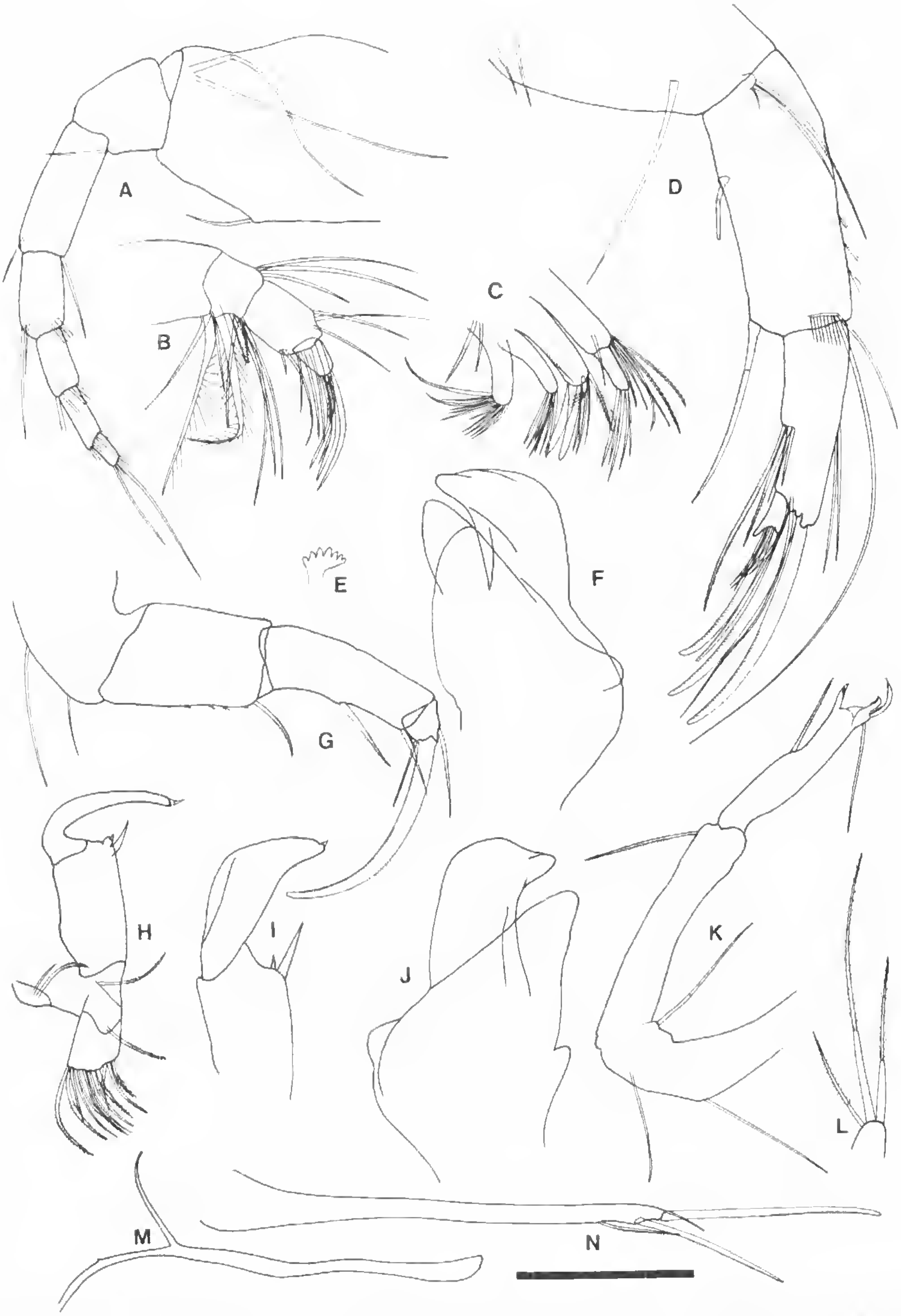

Fig. 6. *Bennelongia australis* (Brady, 1886) a antennula, b mandible—palp, c maxillula—palp and lobes, d antenna, e rake-like organ, f hemipenis, g thoracopoda I, h maxilla, male, i maxilla—endopodite, male, j hemipenis, k thoracopoda II, l maxilla—endopodite, female, m furcal attachment, n furca. a-b, d-k, m-n: adult male—creek pool flowing across the road, 2 km N of Leonora, W.A. c, l: adult female. Scale: 200$\mu$.

Rake-like organ: (Fig. 6e) Five teeth plus another bifid one on inside of each rake.

Maxillula: (Fig. 6c) Length/width ratio of palp segments: 4/1, 4/1; 3rd lobe with two smooth Zahnborsten and tufted thick seta at end of 3rd lobe near Zahnborsten. About 17 plumose Strahlen on epipod plate.

Maxilla: Sexually dimorphic: in female (Fig. 6l) three unequal plumose setae at tip of endopod; in male (Figs 6h,i) grasping palps unequal, broadest one on right side—for chaetotaxy see Fig. 6h.

Thoracopoda I: (Fig. 6g) Geniculate distal part of 1st segment with two setae, proximal one being almost twice as long as other. Penultimate segment weakly divided. Inner distal seta of 2nd segment shorter than 0.5 length of 3rd segment and shorter than distal outer seta of terminal segment. Inner distal end of penultimate segment with two unequal setae. Inner distal seta on the 4th segment is about 0.33 of length of distal claw.

Thoracopoda II: (Fig. 6k) Distal setae unequal: large one more than twice length of other which is hook-shaped. Broad pincers present distally.

Hemipenis: (Figs. 6f,j) Lateral lobe broad with inner distal end pointed and curved inward. Copulatory sheath broadly triangular in shape with round inner distal end reaching almost curved tip of lateral lobe. Outermost point of sheath forms hump and coresponds to mid-length of inner side of sheath.

Zenker organ: With 33 rosettes.

Furca: (Fig. 6n) Claws narrow, long and unequal and posterior seta longest of the two. Furcal attachment: (Fig. 6m) Bifurcate at distal end; median branch thickest and other two branches arched inwards.
Eye: Dark brown with two lateral silver lenses.

*Colour of shell.* Green to pale green.

*Size:*

lectotype: adult left valve

| | L | H |
|---|---|---|
| LV | 1980μ | 1200μ |

| | | L | H | | L | H |
|---|---|---|---|---|---|---|
| adult male | LV | 1860μ | 1060μ | RV | 1740μ | 1100μ |
| adult female | LV | 2220μ | 1300μ | RV | 2060μ | 1220μ |

*Remarks:* Examination of the type specimens of *Chlamydotheca australis* Brady, 1886 in the British Museum necessitates the following clarification. One adult left valve (L 1980 μ, H 1200μ), designed here as the lectotype, is the valve probably illustrated by Brady (1886) on Plate IX.7. The tip of the beak-like feature of this left valve is broken off. In the same slide, there is another left valve which probably belongs to a *Heterocypris* sp. It is likely that this valve is the one thought by Brady (1886) to be the right valve of *C. australis* and illusstrated by him on Plate IX.8. It definitely lacks the peripheral posteroventral tubercles and the broad inner lamella anteriorly so typical of all *Bennelongia* species and the anteroventral flange of *B. australis* specimens. This would explain the incorrect description of the right valve of this species provided by Brady (1886, p. 91). Examination of one carapace of *B. australis* from a slide bearing Brady's handwriting in Sars' collection in the Oslo Museum further confirms Brady's misidentification.

Finally, in the same slide from the British Museum, there are two partly broken carapaces of smaller *Bennelongia* species (length 1360 μ, height 800 μ) with some dried soft parts inside. Their specific identification remains uncertain although it is thought they belong to *B. barangaroo*.

In 1894, Sars synonymized *C. australis* Brady, 1886 with *Cypris bennelong* King, 1855 maintaining that Brady's specimens were the same as those of King, and by stating that the latter author had described the species from juvenile specimens. This was repeated by Sars (1896) and Henry (1923). Sars' suggestion cannot be accepted because King (1855) stated on page 63 that *C. bennelong* has 'equal valves'. This is not the case for adult *Bennelongia* species. Sars' (1894) argument of King's specimens being juveniles cannot be accepted here either since juveniles of *Bennelongia* (which have symmetrical valves) are either deeply punctated all over or are strongly tuberculated. These features are best seen on specimens described by Sars (1896) as *Cypris lateraria* King, 1855 which are juveniles of *Bennelongia* spp. Either tubercles or pitted shell would have surely been diagnosed by King otherwise.

Sars' specimens described from Australia (Sars 1896) and New Zealand (Sars 1894) as *C. bennelong* are true *Bennelongia* species but do not belong to *B. australis*. Since they cannot be identified as King's species, they are therefore renamed here as *B. barangaroo* n.sp. This species is described below.

*Ecology and distribution: B. australis* was originally collected from Penola, S.A. by Prof. R. Tate. The specimens were empty shells (Brady 1886). This species inhabits mainly temporary pools and, so far, has been found alive only in Western Australia and South Australia. Adult males have been found in a permanent lake in Western Australia, suggesting that the mode of reproduction is parthenogenetic in ephemeral environments.

Localities: W.A.: Roadside pool 2.3 km S of Northcliffe; roadside pool Pfeiffer's Road, 8 km from Mary Peaks; Lake Sadie, east of Wilson Inlet (near Denmark); creek pool flowing across the road 2 km north of Leonora; roadside pool 5 km S of Cunderdin; roadside pool on eastern side of road between Quairading and Corrigin (25 km northwest of Corrigin); Lake Biddy. S.A.: Roadside pool, 3 km east of Rocky River, Kangaroo Island.

Water was fresh except in the last two sites in Western Australia where salinity was 4.4 and 3.5‰, respectively.

### **Bennelongia barangaroo** n.sp.

FIGS 7–8, 9 a–q

1894 *Cypris bennelong* King: Sars, p. 24.
1896 *Cypris bennelong* King: Sars, p. 49.
1896 *Cypris lateraria* King: Sars, p. 53.
1923 *Cypris bennelong* King: Henry, p. 275.

*Diagnosis:* Area just behind beak-like feature of left valve slightly concave; outline of hemipenis as in Fig. 8j.

*Description: Carapace.* (External) Adult: circular to oval carapace smooth or covered with faint pustules and pilose. Ventrum flattened. Valves asymmetrical: left valve larger, especially anteriorly with largest overlap ventrally; anteroventral region of left valve slightly concave to form beak-like feature whereas right valve broadly rounded and with an elongated and narrow beak-like serrated flange anteroventrally. Simple type normal pore canals.

Juvenile: More elongated in lateral view, with symmetrical, pitted or tuberculated valves.

(Internal) Adult: Inner lamella twice as broad anteriorly in both valves, selvage peripheral ventrally, away from outer margin posteriorly and especially anteriorly; inner list forming lip-like flap far away from edge of shell anteroventrally which is preceded by a deep, narrow groove. A ridge follows curvature of inner margin anteriorly but fades opposite tongue-like flap. Few small tubercles are visible on this ridge above concave depression of shell. Outer list often broad posteroventrally. In right valve, selvage peripheral and sharp posteriorly, broad anteroventrally and faint anterodorsally. In many specimens, edge of shell near flange distorted to form an obvious concavity which is paralleled by a depression. A row of tubercles along periphery of shell posteroventrally. Outer list also broader posteroventrally and usually pitted externally near edge of shell; this is best seen in ventral area.

Juvenile: In both valves, inner lamella of almost equal width all around and selvage, which follows the curvature of the shell, prominent.

*Anatomy:* Only the features of the anatomy which differ significantly from *B. australis* and other *Bennelongia* species are mentioned. For other details refer to Fig. 8.

Antennula: Natatory setae slightly longer than all segments together.

Maxilla: Male grapsing palps (Figs 8g,h) of different shape than *B. australis:* left palp shorter and broader and right one with outer edge forming 90°.

Thoracopoda I: (Figs 8d,e) Inner distal seta of second segment at least as long as half of 3rd segment; longest inner seta at mid-length of 3rd segment (where it is weakly divided) at least as long as 2nd half of 3rd and 4th segments together. Inner distal seta on 4th segment 1/2.3 of length of distal claw.

*Colour of shell:* Green.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 1120μ | 700μ | RV | 1100μ | 660μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 1160μ | 700μ | RV | 1110μ | 680μ |

Newmann's Rocks adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 1390μ | 780μ | RV | 1320μ | 770μ |

*Derivation of name:* From the aboriginal name of Bennelong's wife Barangaroo.

*Type locality:* Lake Buchanan, Qld (21°35'S, 145°52'E).

*Ecology and distribution: B. barangaroo* is a common inhabitant of temporary pools and usually is only represented by parthenogenetic females. On one occasion, in Lake Buchanan, both sexes were found. There salinity was

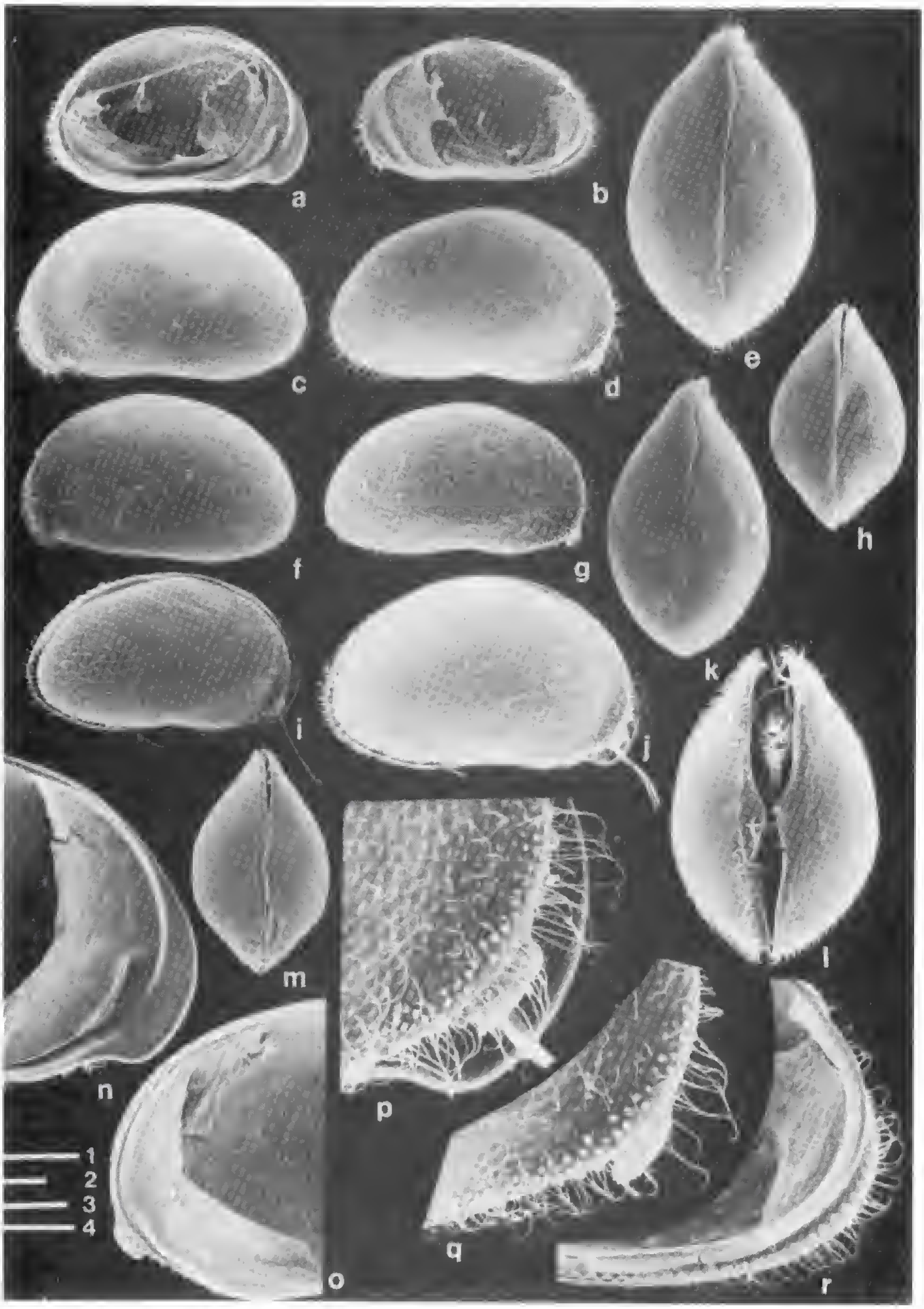

Fig. 7. *Bennelongia barangaroo,* n.sp. a LV internal,, holotype male, b RV internal, holotype male. c LV external, paratype female. d RV external, paratype female. e C dorsal, paratype female. f LV external, paratype male. g RV external, paratype male. h C dorsal, juvenile. i C showing RV, paratype male. j C showing RV, paratype female. k C dorsal, paratype male. l C ventral, paratype female. m C ventral, juvenile. n LV internal, detail anterior of paratype female. o RV internal, detail anterior of paratype female. p C showing RV, detail anterior of j. q RV external, detail anterior of d. r RV internal, detail posterior of b. Scale: 1—250μ for a-m; 2—100μ for n-o; 50μ for q; 3—50μ for p; 4—100μ for r.

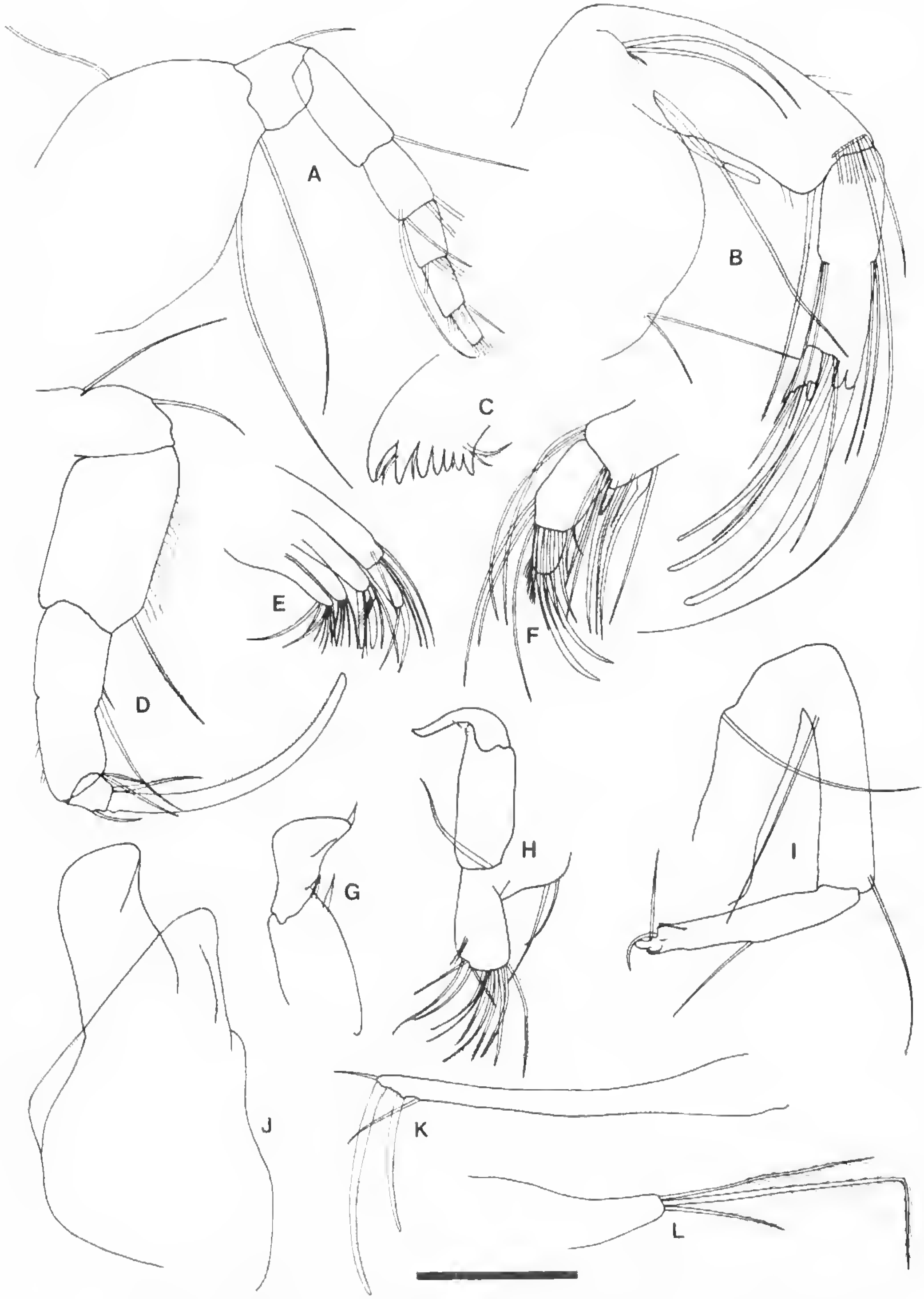

Fig. 8. *Bennelongia barangaroo,* n.sp. a antennula, b antenna, c mandible—coxale, d thoracopoda I, e maxillula—palp and lobes, f mandible—palp, g maxilla—endopodite, male, h maxilla; male, i thoracopoda II, j hemipenis, k furca, l maxilla—endopodite, female, a-b, d-k: holotype adult male; c l: paratype adult female. Scale: 100μ.

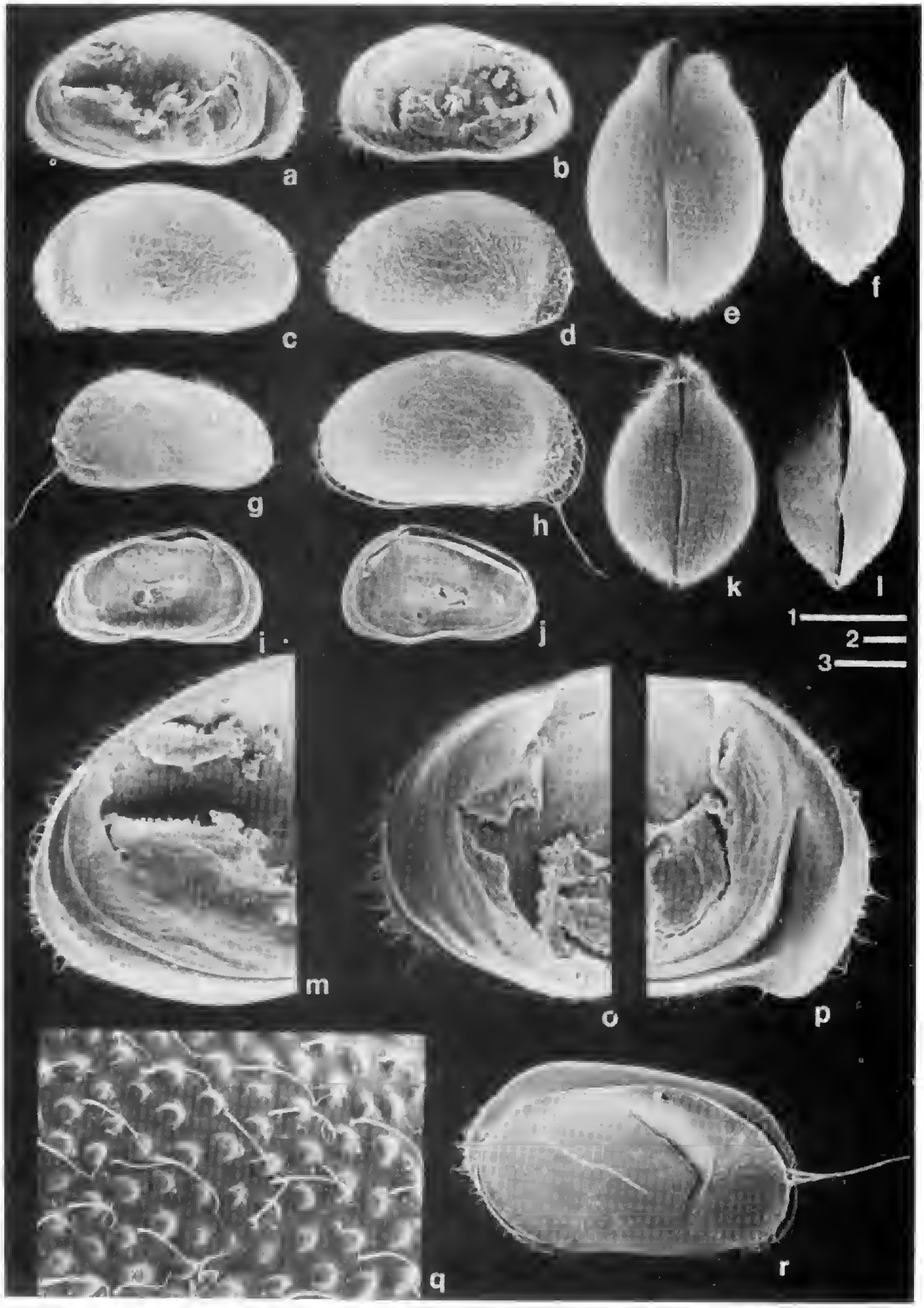

Fig. 9. *Bennelongia barangaroo* n.sp. a LV internal, female. b RV internal, female. c LV external, female d RV external, female. e C dorsal, female. f C dorsal, juvenile. g C showing LV, juvenile. h C showing RV, female. i LV internal juvenile. j RV internal juvenile. k C ventral, female. l C ventral, juvenile. m LV internal, posterior detail of a. o RV internal, anterior detail of b. p LV internal, anterior detail of a. q C dorsal, detail of e. a-q: elongated pool in creek bed, about 25 km N of Cue, W.A. *Bennelongia* sp. r C showing RV. Cauckingburra Swamp, at Lake Buchanan, via Charters Towers, Qld. Scale: 1—500μ for a-k; 2—100μ for m-p; —20μ for q; 3—500μ for r.

4.1‰. In other localities listed below, water was known to be fresh.

Live specimens with tuberculated symmetrical valves collected in a farm dam at Frome Downs near Lake Frome, S.A. were examined in the laboratory. They resembled specimens illustrated by Sars (1896a) on Plate VII: Fig. 3 and labelled by him as *Cypris lateraria* King, 1855. After a few days, these specimens, which had traces of ovaries inside the valves, were seen to molt into *B. barangaroo* with its typical asymmetrical valves. Eggs of the latter developed into small highly ornamented ostracods like *C. lateraria*. This phenomenon requires the two taxa to be synonymized.

Localities: W.A.: granite pool, Newmann's Rocks, 140 km E of Norseman; roadside ditch 37 km W of Esperance (road to Ravensthorpe) and 3.5 km east of Dalyup River; small roadside pool about 18 km northeast of Menzies; elongated pool in bed of Cookarrow Creek, about 5 km W of Wiluna; pool in creek bed about 25 km N of Cue; small farm dam on eastern side of road 9 km S of Cunderdin on the way to Quairading. S.A.: Farm dam at Frome Downs, near Lake Frome. Qld: Creek, 22 km E of Richmond; roadside pool at Miranda; Lake Galilee, near Aramac; Lake Dunn, south of Lake Galilee. N.S.W.: Specimens raised by Sars from sample of dried mud collected in waterholes by Mr Whitelegge in Bourke Street, Sydney (Sars 1896). New Zealand: Specimens raised from dried mud sample collected near Kaitaia in the North Island. Chapman (1963) stated that this species had not been found in New Zealand since Sars' (1894) description and no further localities are provided in Chapman & Lewis (1976).

*Remarks: B. barangaroo* is closely allied to *B. australis* but the species can be separated on the basis of size (*B. australis* is much larger), on the outline of the hemipenis and the chaetotaxy of the thoracopoda I.

The specimens of *B. barangaroo* described here are identical in morphology to Sars' specimens from Bourke Street, Sydney and from New Zealand. It is assumed here that the specimens reported as *Cypris lateraria* by Sars (1896) from the Sydney site are juveniles of *B. barangaroo*.

The shape and width of the anteroventral flange on the right valve of *B. barangaroo* can vary extensively: in the specimens from Lake Buchanan, the edge of the flange is serrated (Figs 7p,q).

### **Bennelongia nimala** n.sp.

FIGS 10–11

*Diagnosis:* Oval to subrectangular, pustulose carapace with posterior slightly pointed and ending with one or two spines. Hump-like thickening of shell anterodorsally. Posterior seta of furca about 0.7 of length of posterior claw and lateral outline of hemipenis as in Fig. 11g.

*Description: Carapace.* (External) Adult: Oval to subrectangular-shaped with posterior slightly pointed and ending with one or two spines. In dorsal view, egg-shaped with anterior end narrow and more pointed than posterior. Valves obiously asymmetrical in anteroventral area: there, left valve formed like pointed beak whereas in right valve, it is broadly rounded and there is a small beak-shaped serrated flange. Posterior to flange, edge of right valve slightly concave. Tip of beak does not reach horizontal plane formed by ventral area. Greatest height at about 0.33 from anterior. Shell pilose, pseudopunctated and pustulose nearly all over. Along edge of left valve, especially, pustules more concentrated and some are pointed, especially anteriorly.

Juvenile: Pseudopunctate, subtriangular shell with many pointed tubercles scattered all over but with greater concentration anteriorly and posteriorly. Valves symmetrical. In dorsal view, oval-shaped with both ends pointed.

(Internal) Adult: Inner lamella broadest anteriorly in both valves. In left valve, selvage narrow and peripheral; inner list forming lip-like flap anteroventrally. This flap fades in anterodorsal region. In front of flap in ventral area, a deep narrow groove. Between outer margin and just behind beak ventrally, is a ridge which is tuberculate in some specimens. In anterior area, in front of hinge area, is a deep groove running parallel to curvature of shell which is placed near outer margin. This groove absent in beak-like area. In right valve, selvage narrow and runs parallel to curvature of shell except at mid-height anteriorly where it is not visible. Anteriorly, in region where serrated flange present, a small ridge runs parallel to, and between, selvage and inner margin.

Juvenile: Inner lamellae equal in both valves and of same width all along. Selvage broad and peripheral.

*Anatomy:* Same remarks as for *B. barangaroo*. For details of anatomy, refer to Fig. 11.

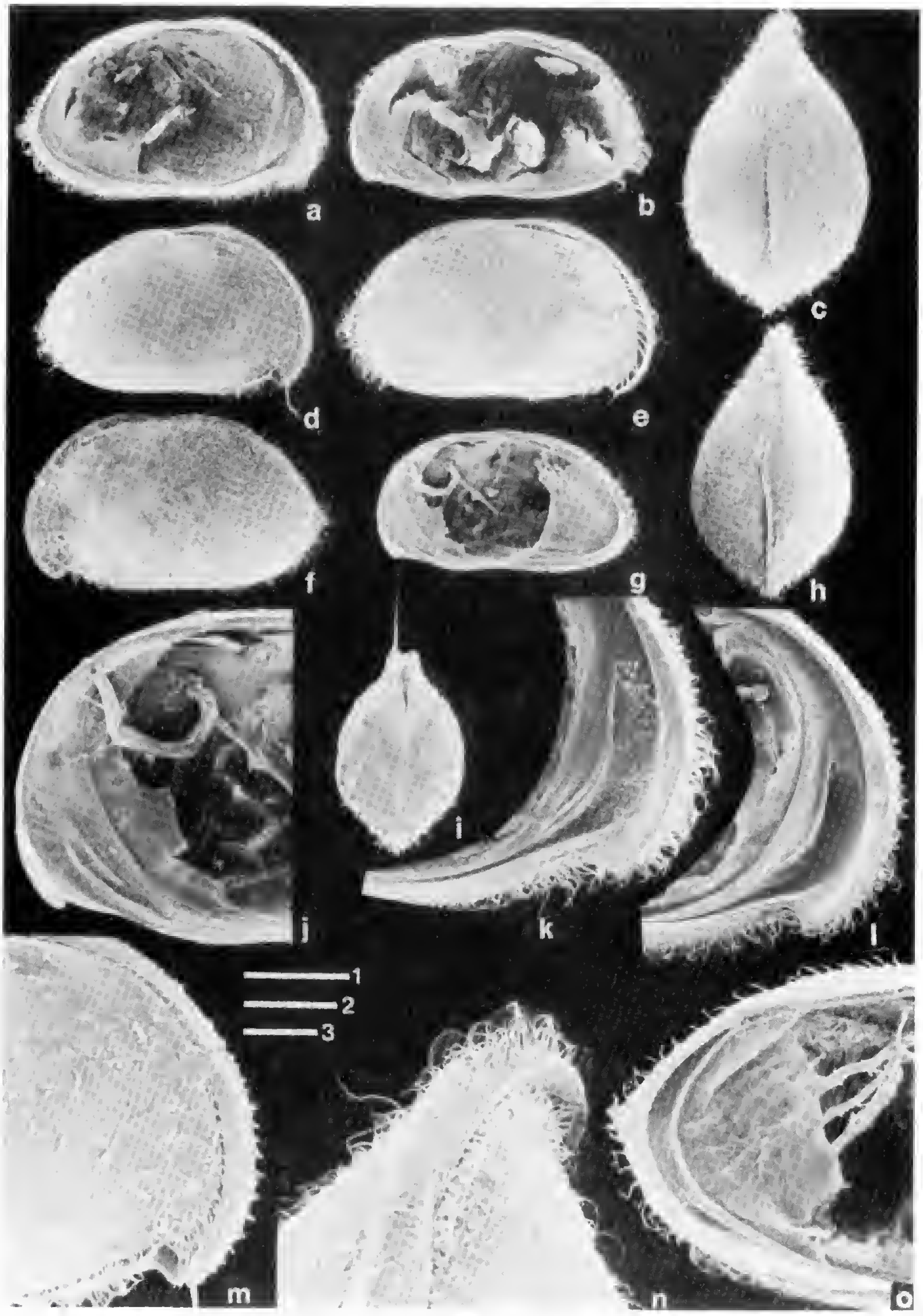

Fig. 10. *Bennelongia nimala* n.sp. a LV internal, female paratype. b RV internal, female paratype. c C dorsal, female paratype. d C showing RV, male. e C showing RV, female paratype. f C showing LV, female paratype. g RV internal, male holotype. h C ventral, male paratype. i C dorsal, juvenile. j RV internal, anterior detail of g. k LV internal, anterior detail of a. l LV internal, anterior detail of male paratype. m C showing RV, anterior detail of d. n C dorsal, anterior detail of c. o LV internal, posterior detail of male paratype. a-c, e-h, j-l, n-o: Georgetown Lagoon, near Jabiru, N.T. (type locality). d, i, m: Buffalo Billabong, near Jabiru, N.T. Scale: 1—500μ for a-i; 2—200μ for j-m, o; 3—100μ for n.

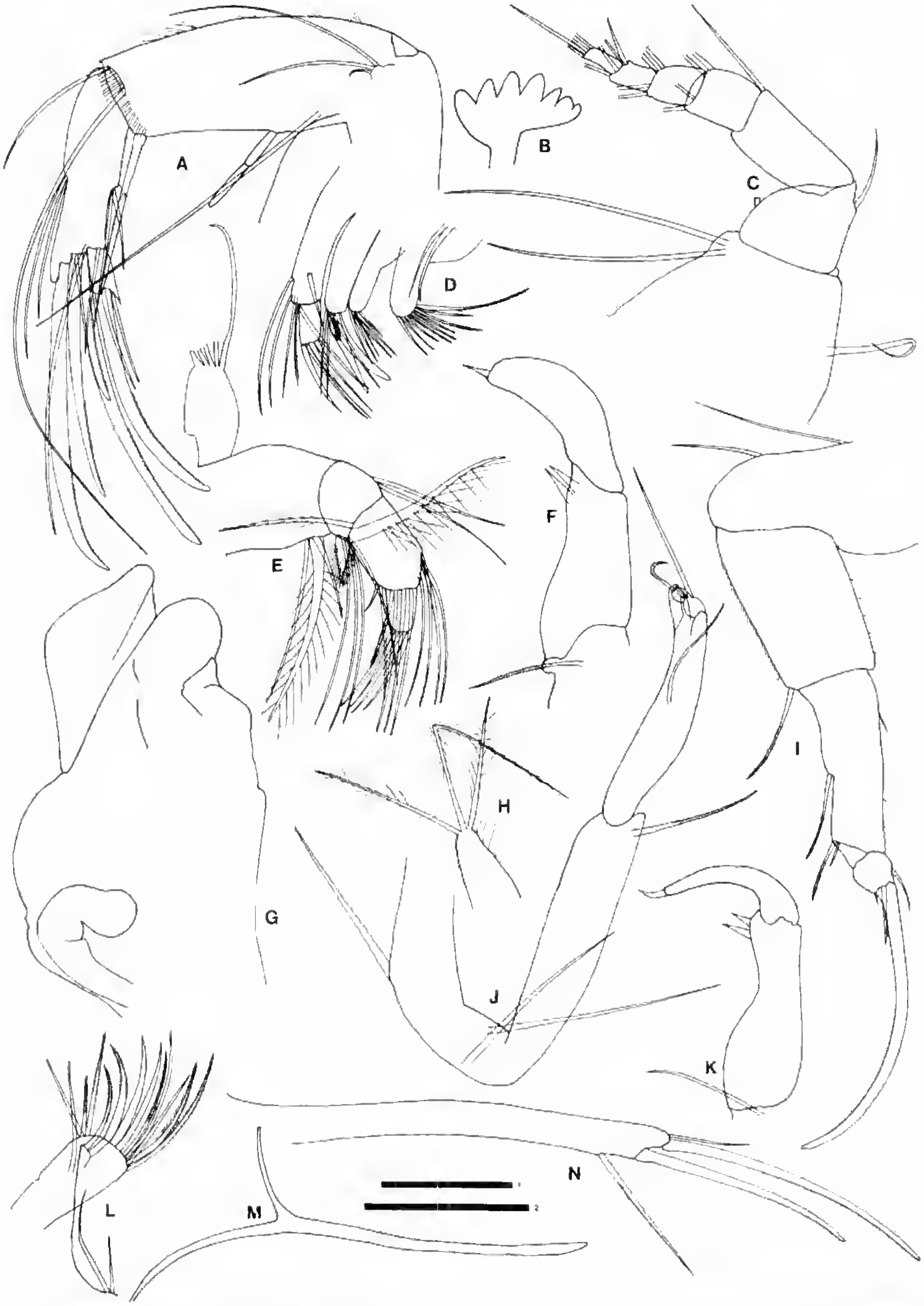

Fig. 11. *Bennelongia nimala* n.sp. a antenna, b rake-like organ, c antennula, d maxillula—palp and lobes, e mandible—palp, f maxilla—endopodite, male, g hemipenis, h maxilla—endopodite, male, i thoracopoda I, j thoracopoda II, k maxilla—endopodite, male, l maxilla—protopodite, female, m furcal attachment, n furca. a-c, e-g, i, k-m: holotype adult male; d, h, j, n: paratype adult male. Scale: 1—100μ for a, c-n; 2—50μ for b.

Antennula: (Fig. 11c) Natatory setae as long as all segments together.

Maxilla: Male palps asymmetrical (Figs 11f,k) with right one broader and less arched. Two external setae on female palp (Fig. 11h) of equal length and plumose.

Thoracopoda I: (Fig. 11i) Inner distal seta of 2nd segment almost reaches weakly divided area in middle of 3rd segment where another seta of similar length occurs. Inner distal seta of 4th segment 1/5.6 of length of distal claw.
Hemipenis: (Fig. 11g) Lateral lobe broad: greatest length equals its greatest width. Near base of lateral lobe on inner side, copulatory sheath in form of circular lump.

Zenker organ: Funnel-shaped at both ends, with 30 rosettes.

Furca: (Fig. 11n) Posterior seta long, approximately 0.7 length of posterior claw.

*Colour of shell:* Green to dark green with broad transversal white stripes best seen in dorsal view.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 1500μ | 840μ | RV | 1340μ | 760μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 1640μ | 960μ | RV | 1540μ | 860μ |

*Type locality:* Georgetown Lagoon, Jabiru, Northern Territory.

*Derivation of name:* The word *nimala* in abori-language of the Northern Territory means lagoon, for the typical habitat of this species.
*Ecology and distribution: B. nimala* is a freshwater species found in lagoons near Jabiru, east of Darwin, N.T.: Jabiluka Billabong, Buffalo Billabong and Mudginberri Lagoon. Both sexes were always found in the collections.

### **Bennelongia pinpi** n.sp.

FIGS 12–13

*Diagnosis:* Anteroventral area of left valve strongly beak-shaped extending below horizontal plane of flat ventral area. In dorsal view, carapace almost circular, with both ends broadly pointed. Outline of hemipenis as in Fig. 13e.

*Description: Carapace.* (External) Adult: triangular to semicircular with flat ventral area; greatest height at about middle. Anteroventral area of both valves beak-like but more pronounced in left valve. Surface of shell smooth to pseudopunctate and barren of hairs except in mouth region. In dorsal view, carapace almost circular with anterior and posterior ends broadly pointed. At about 0.17 from anterior, shell pinched, being more noticeable in posteroventral area. Valves strongly asymmetrical anteroventrally where left valve larger, elsewhere left valve slightly overlapping right valve.

Juvenile: Subtriangular with ventrum almost flat and greatest height at about 0.4 from anterior. In dorsal view, carapace oval to almost circular with both ends pointed. Largest juveniles with pseudopunctated shell and few tubercles. In very small juveniles, shell pitted and thinly reticulated and with some sieve plates. Most tubercles are cone-shaped and a hair protrudes from each of them. Valves almost symmetrical with left slightly larger.

(Internal) Adult: Inner lamella much broader anteriorly in both valves. In left valve, inner list forms broad lip anteroventrally and is absent anterodorsally. Selvage narrow ventrally and distant from outer margin and broader posteroventrally where it is placed in middle of inner lamella. Above concavity behind beak-like form in anterior of shell, there are a few tubercles between outer margin and lip-like inner list. Depression in front of lip-like inner list and another near outer margin anterodorsally. In right valve, selvage narrow and peripheral. A broad tongue-like flange anteroventrally in some valves which is enclosed by broader beak-like left valve when carapace closed. An outer list runs parallel to curvature of right valve and bordered by small tubercles ventrally except in mouth region.

Juveniles: Inner lamellae twice as broad anteriorly and with broad and prominent selvage following curvature of shell. Outer list runs parallel to curvature of both valves and bordered inside by faint tubercles in some juveniles.

*Anatomy:* As for other species. For details of the anatomy, see Fig. 13.

Antennula: (Fig. 13b) Natatory setae almost as long as all the segments together.

Maxillula: Male palps (Figs 13i,j) asymmetrical with right one broader although both are similarly arched.

Thoracopoda I: (Fig. 13g) Inner distal seta on 2nd segment almost reaches level of weak division of 3rd segment. There, inner distal seta long, extending past 4th segment. Length

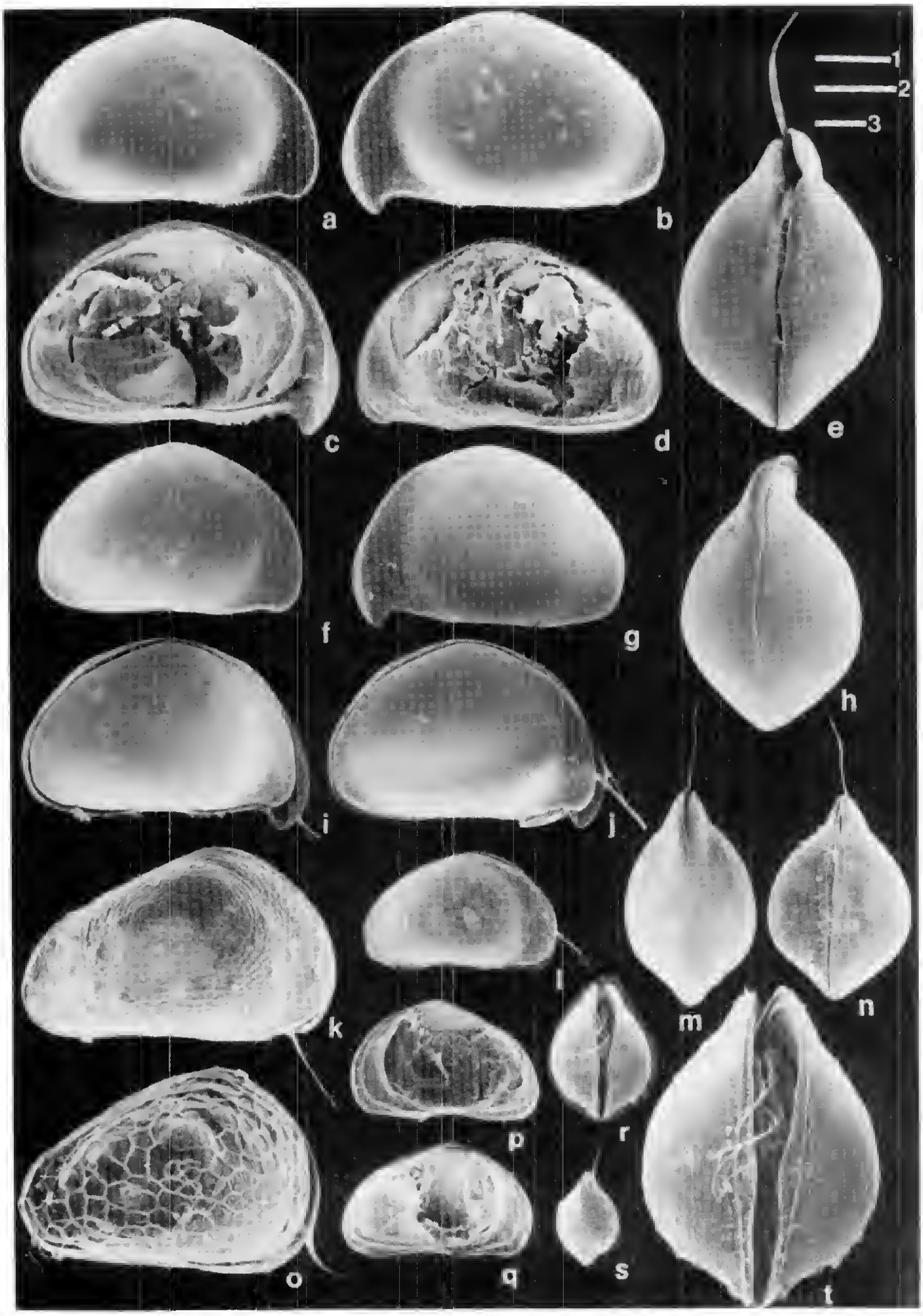

Fig. 12. *Bennelongia pinpi,* n.sp. a RV external, female paratype. b LV external, female paratype. c LV internal, female paratype. d RV internal, female paratype. e C ventral, female paratype. f RV external, male holotype. g LV external, male holotype. h C dorsal, male paratype. i C showing RV, male paratype. j C showing RV, female paratype. k C showing RV, juvenile. l C showing RV, juvenile. m C dorsal, juvenile. n C ventral, juvenile. o C showing RV, juvenile. p RV internal, juvenile. q LV internal, juvenile. r C ventral, juvenile. s C dorsal, juvenile. t C ventral, enlargement of r. Scale: 1—500μ for a-p, l-n, p-s; 2—200μ for k; —300μ for t; 3—150μ for o.

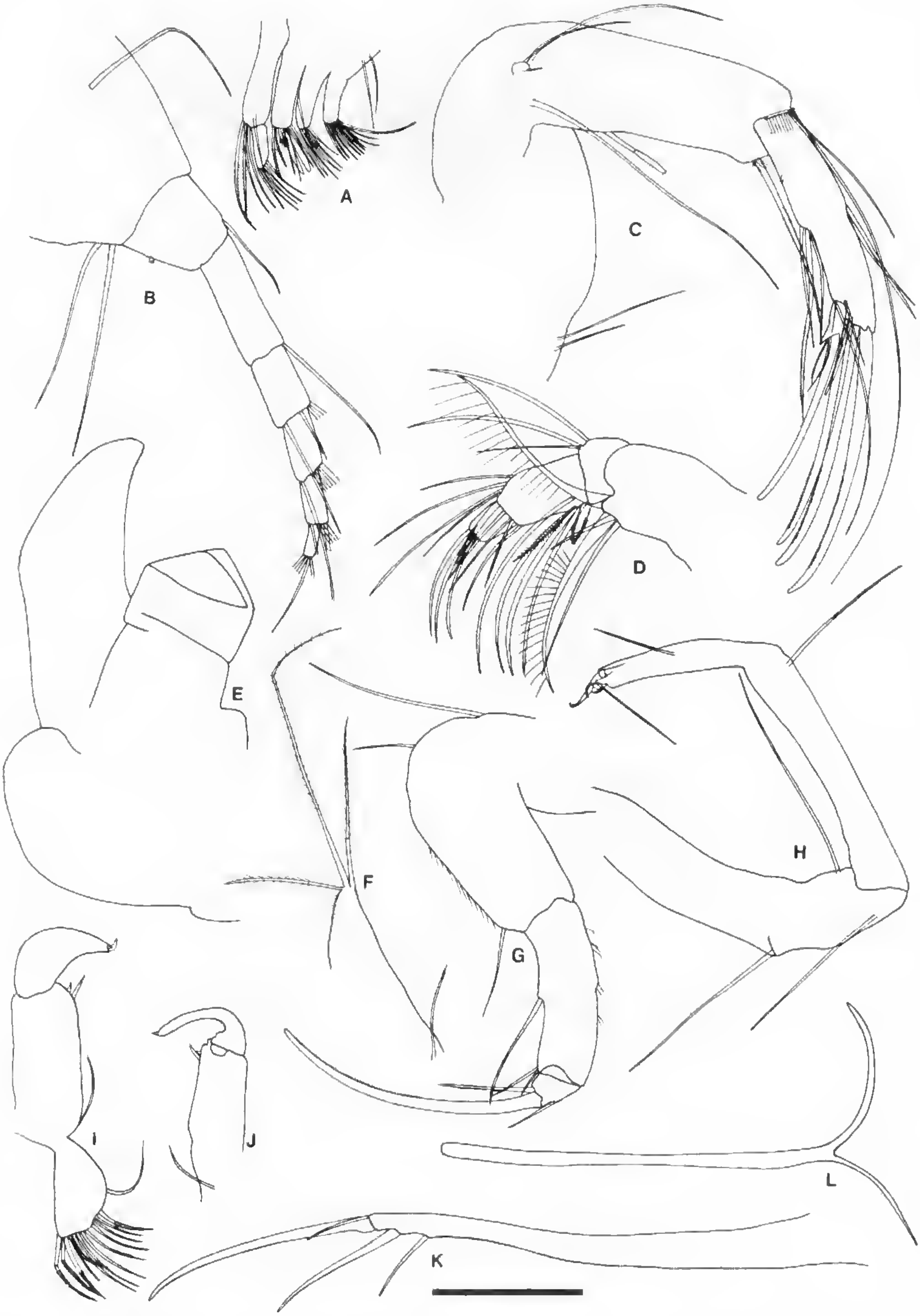

Fig. 13. *Bennelongia pinpi,* n.sp. a maxillula—palp and lobes, b antennula, c antenna, d mandible—palp, e hemipenis, f maxilla—endopodite, female, g thoracopoda I, h thoracopoda II, i maxilla, male, j maxilla—endopodite, male, k furca, l furcal attachment. a-c, e, g-k: holotype adult male; d, f, l: paratype adult female. Scale: 200$\mu$.

ratio of distal seta of 4th segment and distal claw is 1/3.5.

Hemipenis: (Fig. 13e) Outer lobe broad and digitate and, near its base on inner side, copulatory sheath forms broad trapezoid-shaped extension.

Zenker organ: With 42 rosettes.

Furca: (Fig. 13k) Setae almost equal-posterior one longer and about 0.5 length of posterior claw.

*Colour of shell:* Light green.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 2480μ | 1600μ | RV | 2340μ | 1420μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 2580μ | 1640μ | RV | 2440μ | 1520μ |

*Type locality:* Pine Tree Creek Lagoon, N of Hughenden, and exactly 16 km S of Louisa Lake on road to Hughenden, Qld (20°00'30" S, 144°16'44" E).

*Derivation of name:* The aboriginal word *pinpi* in Queensland meaning parrot is chosen for the anteroventral area of the shell which resembles the beak of a parrot.

*Ecology and distribution:* This freshwater species is known from three other localities in Queensland: Agnes Lake, Salt Lake (fresh) and Louisa Lake, all three N of Hughenden.

### SUBFAMILY: EUCYPRIDINAE Bronstein, 1947

### *Australocypris* De Deckker, 1974

*Type species: Australocypris robusta* De Deckker, 1974.

*Remarks:* The following species are discussed in the present work and can be distinguished on the outline of the hemipenis: *A. dispar* n.sp., *A. insularis* (= *A. hypersalina*), *A. rectangularis* and *A. robusta*. All *Australocypris* species are halobiont and planktic but can also crawl on lake floors. Rarely do two species occur together in one lake.

### **Australocypris dispar** n.sp.

FIGS 14, 15 a–i

*Diagnosis:* Lateral lobe of hemipenis digitate and broad at base; long distal seta on 4th segment of thoracopoda I.

*Description: Carapace.* (External) Pseudopunctate, subrectangular carapace with anterior end broadly rounded, dorsum slightly inclined and posterior steeply inclined. Ventrum strongly concave past mid-length from the anterior. Greatest height at about 0.4 in female and 0.33 in male. In dorsal view, carapace elongated, length more than twice width, and both extremities slightly pointed. Left valve slightly larger in female and ventral overlap minimal. Both valves extend over one another in anterodorsal area just before hinge. Simple normal pore canals.

(Internal) Inner lamella narrow in both valves and selvage faint and between edge of valve and selvage which is prominent in that area. Radial pore canals numerous and straight. Central muscle field consisting of five adductor scars and two large mandibular ones in front and below.

*Anatomy:* Antennula: (Fig. 14c) Length/width ratio of last six segments: 2/3, 2/1, 1/1, 5/3.5, 2/1.4, 4/3. Small wart-like "sensory" organ on side of 2nd segment. Natatory setae as long as last six segments together.

Antenna: (Fig. 14a) Massive and sexually dimorphic: four claws in male and three in female: smallest one in male attached to last segment and with long comb-like teeth. Natatory setae almost reaching tip of claws.

Mandible: Mandibular coxale (Fig. 14h) with seven teeth, the last one longer, narrower than penultimate and, at base, three setae occur, two of which are pilose. Endopod (Fig. 14d) with $\alpha$ bristle short, narrow and barren; $\beta$ bristle stout and finely pilose; $\gamma$ bristle twice as long as others and pilose in distal half. Distal segment of endopod 0.33 of length of penultimate segment.

Rake-like organ: Seven short and stout teeth plus one inner bifid one on each rake.

Maxillula: (Fig. 14b) Endopod with 23 plumose Strahlen; length/width ratio of palps: 3/1.3, 1.5/1.1 with last segment slightly trapezoidal. Two toothed Zahnborsten on 3rd lobe.

Maxilla: Sexually dimorphic: in male (Figs 14j,k), palps almost symmetrical, strongly curved and narrow; in female (Fig. 14f), palp faintly divided at its extremity and with three short pilose setae, the middle one being twice as long as others.

Thoracopoda I: (Fig. 14e) Penultimate segment weakly divided; distal segment with long inner seta 0.5 length of distal claw. Thoraco-

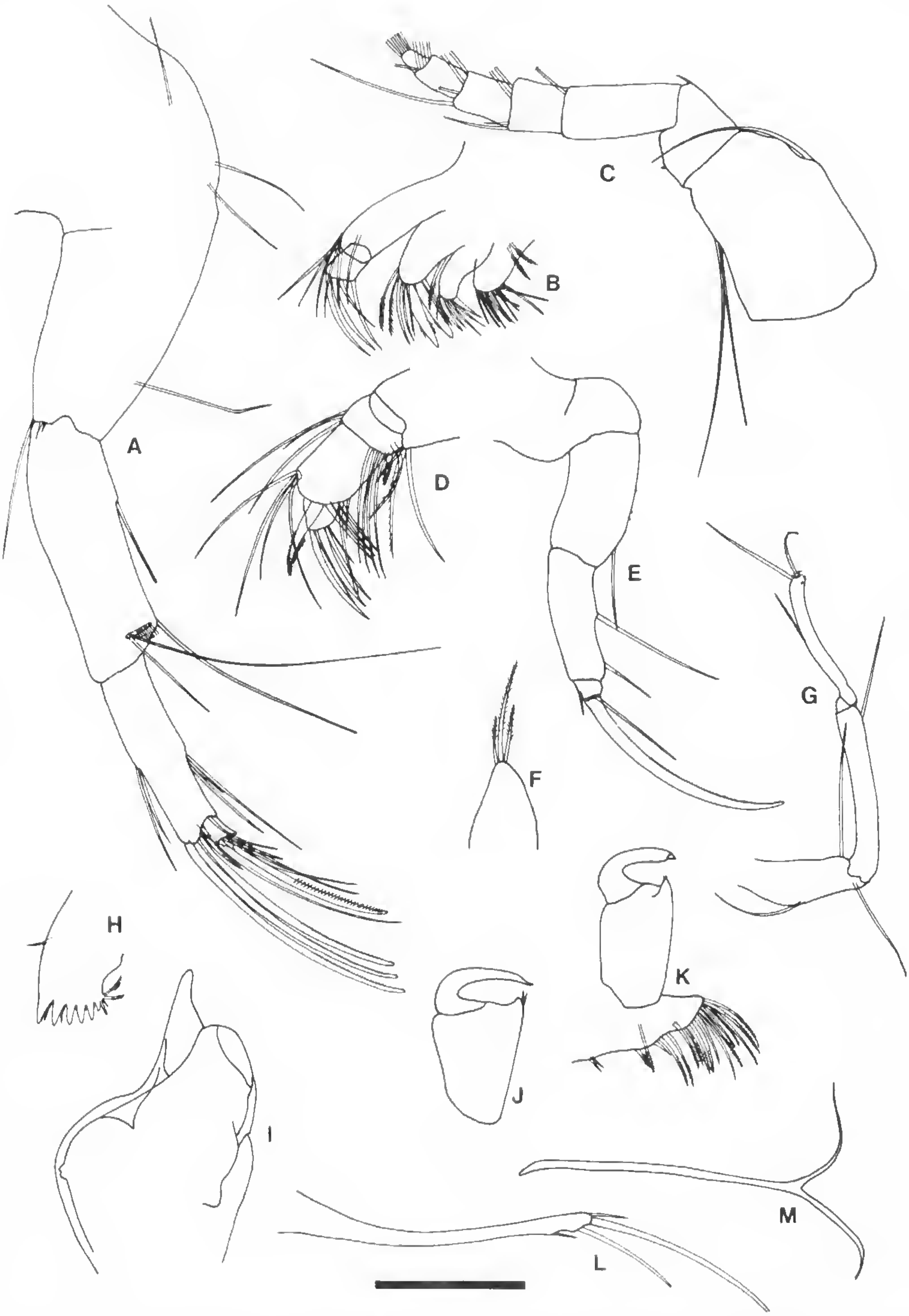

Fig. 14. *Australocypris dispar* n.sp. a antenna, b maxillula—palp and lobes, c antennula, d mandible—palp, e thoracopoda I, f maxilla—endopodite, female, g thoracopoda II, h mandible—coxale, i hemipenis, j maxilla—endopodite, male, k maxilla, male, l furca, m furcal attachment. a, c-e, g-m: holotype adult male; b, f: paratype adult female. Scale: 200μ.

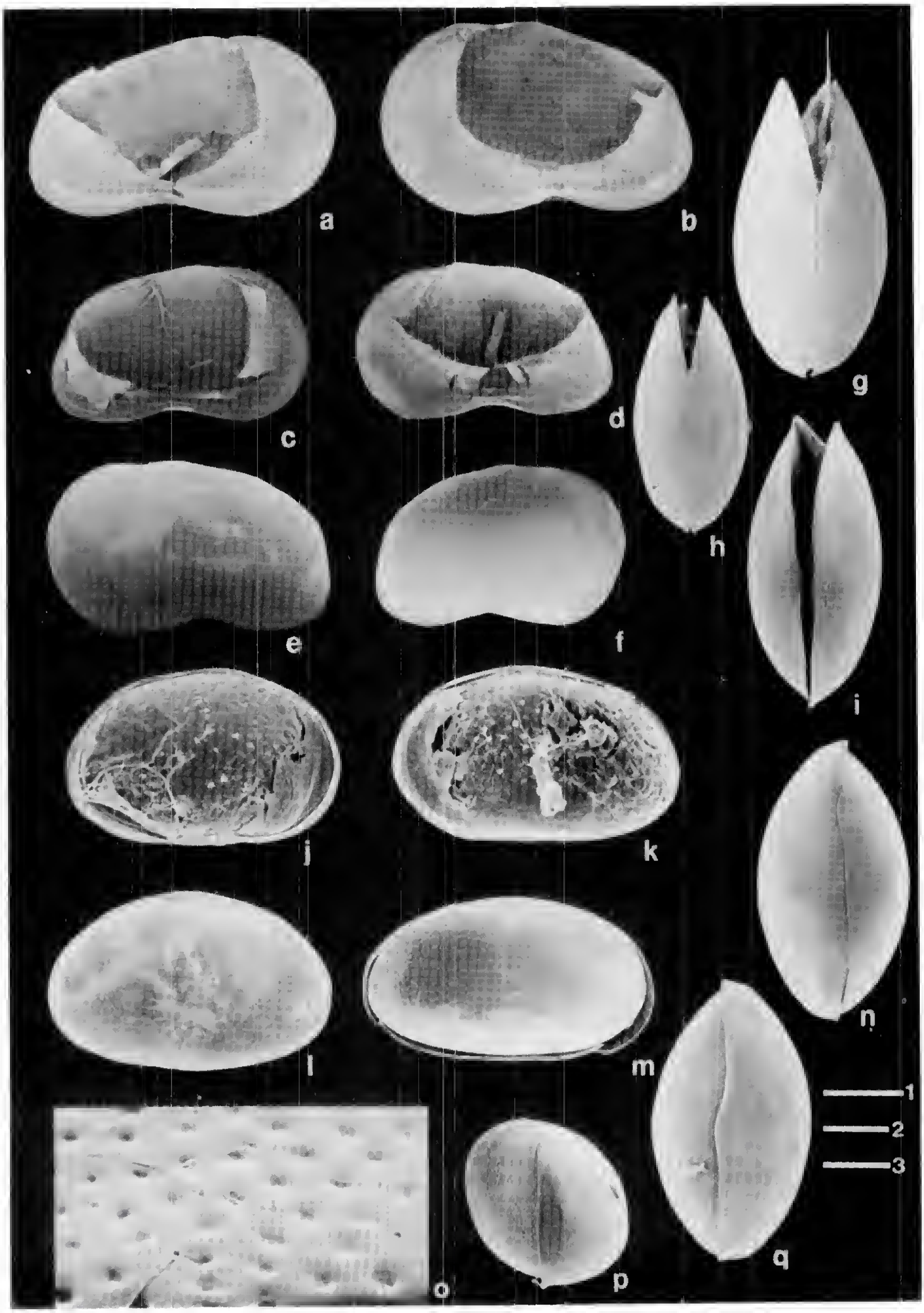

Fig. 15. *Australocypris dispar* n.sp. a LV internal, female paratype. b RV internal, female paratype. c LV internal, male holotype. d RV internal, male holotype. e C showing LV, female paratype. f C showing RV, male paratype. g C dorsal, female paratype. h C dorsal, male paratype. i C ventral, female paratype. *Strandesia phoenix* n.sp. j LV internal, female holotype. k RV internal, female holotype. l C showing LV, female paratype. m C showing RV, female paratype. n C dorsal, female paratype. o C anterior, detail of p. p C anterior, female paratype. q C ventral, female paratype. Scale: 1—1000μ for a-i; 2—200μ for j-n, p-q; 3—20μ for o.

poda II: (Fig. 14g) Elongate and narrow segments distal segment with two terminal setae and two pincers; shortest seta hook-shaped.

Hemipenis: (Fig. 14i) Lateral lobe digitate and slightly curved inwards and broad at its base; copulatory sheath broadly heart-shaped. Zenker organ: Long and narrow with both ends rounded and usually 67 rosettes.

Furca: (Fig. 14l) Unequal claws with anterior one 0.66 longer, and anterior seta slightly longer than posterior one.

Furcal attachment: (Fig. 14m) Proximal part bifurcate; dorsal branch strongly arched and about same length as ventral one which follows curvature of median branch.

*Colour of shell:* Nacreous brown.

*Size:*

holotype adult male

|  | L | H |  | L | H |
|---|---|---|---|---|---|
| LV | 3600μ | 2200μ | RV | 3600μ | 2060μ |

paratype adult female

|  | L | H |  | L | H |
|---|---|---|---|---|---|
| LV | 4100μ | 2240μ | RV | 4000μ | 2060μ |

*Type locality:* Ephemeral salt lake south of the Coorong Lagoon, S.A. (36°26′45″S, 139°47′32″E) = loc.5 in De Deckker & Geddes, 1980, collected on 16.X.1978 at 15.5‰ salinity.

*Derivation of name:* From Latin *dispar* meaning different for the unusual long distal seta on the last segment of the thoracopoda I compared to congeners.

*Ecology and distribution: A. dispar* is a halobiont species which occurs in ephemeral saline lakes in S.A. Near the Coorong Lagoon, its salinity range is 9–52‰. De Deckker & Geddes (1980) provide further details on its distribution there as "*A.* n.sp.I." It is also recorded on the Yorke Peninsula at 6‰ in an ephemeral lake (35°03′11″S, 137°35′50″E) and on the Eyre Peninsula in a swamp south of the road near Lake Horn, northwest of Port Lincoln at 32.4‰.

*Remarks: A. dispar* is characterized by the unusually long seta on the distal segment of the thoracopoda I and the faintly divided end of the female maxillar endopodite palp. These characteristics are unknown in other *Australocypris* species but are found in the halobiont ostracod *Limnocypris luridus* Shornikov, 1961, described from the Kuban Delta in the Caspian Sea region of the USSR. Correspondence with Dr E. Shornikov has led to the conclusion that other features of the chaetotaxy of many appendages between *A. dispar* and *L. luridus* differ too greatly to justify close relationship between the two species.

### *Australocypris insularis* (Chapman, 1966)

1966 *Eucypris insularis:* Chapman, p. 375.
1974 *Australocypris hypersalina:* De Deckker, p. 101.
1978 *Australocypris hypersalina:* De Deckker, p. 16.
1978 *Australocypris insularis:* De Deckker, p. 17.

*Remarks:* After examination of many collections of *A. insularis* from Western Australia (from where the species had originally been described), it became clear that *A. insularis* and *A. hypersalina* are conspecific. Both taxa have very similar hemipenes with the characteristic broad and curved lateral lobe and the bulbous inner distal end of the copulatory sheath. This type of lateral outline of the hemipenis is not found in congeners.

The examination of many specimens of *Australocypris* has led to the conclusion that there are slight differences in the morphology of many specimens of *A. insularis* and *A. hypersalina*. Therefore the minor differences of the outline of the hemipenis for the two taxa originally mentioned by De Deckker (1978) are here considered insignificant.

During the revision of all mytilocypridinid species (De Deckker 1978), it appeared that *A. insularis* and *A. hypersalina* differed mainly on characters of the shell, but it has since become apparent that the shape of the shell of th *Australocypris* species is also variable in populations taken during different seasons in the same lake. Large specimens collected during winter and early spring months are usually more elongated. For the same reason, the specimens illustrated in De Deckker, 1978, in Figs 18a,b as *A. hypersalina* show the typical winter form of *A. hypersalina* = *A. insularis* not recognized then, as most collections described in that publication had been taken during summer months.

*Ecology and distribution:* The distribution of *A. insularis* (plus *A. hypersalina*) was dealt with in De Deckker (1977, 1978) and is updated here. The species is commonly found in ephemeral saline lakes near the Coorong Lagoon (see De Deckker & Geddes 1980) where it is found between 5 and 131‰ salinity. It also occurs on the Yorke and Eyre Peninsula in similar ephemeral lakes at the same salinity range. It has also been widely collected in 15 West Australian salt lakes by Geddes *et al.* (1981) over the range of 2.9–122.6‰.

### *Australocypris rectangularis* De Deckker, 1978

1978 *Australocypris? rectangularis*: De Deckker, p. 17.

1980 *Australocypris rectangularis:* De Deckker & Geddes, p. 691.

*Diagnosis:* Lateral lobe of hemipenis narrow and hook-shaped; copulatory sheath almost semicircular. Carapace rectangular.

*Remarks:* The original description of this species was incomplete because a number of appendages had dried out and had been damaged. A number of specimens have since been collected in saline lakes near the Coorong Lagoon by De Deckker & Geddes (1980). They examined the appendages of this species and on morphological grounds referred it with confidence to *Australocypris.*

*Ecology and distribution:* This species is a true halobiont form which has never been found in salinities below 50‰. Near the Coorong Lagoon, its salinity range is 50–195‰ and there is evidence there that it even hatched above 73‰ and 115‰ in two different localities. On the Yorke and Eyre Peninsulas, *A. rectangularis* occurs in the same range of salinities as in the lakes near the Coorong Lagoon.

### *Australocypris robusta* De Deckker, 1974

1974 *Australocypris robusta:* De Deckker, 1974

*Diagnosis:* Chitinous pocket on inside of posterodorsal area in female valves; hemipenis with digitate lateral lobe which is of about same width all along.

*Ecology and distribution:* The salinity range of *A. robusta* in Victoria, already available in Bayly & Williams (1966), of 53.5–93.1‰ and of 4.4–132‰ in Geddes (1976) is broadened to the range of 7–145‰ obtained from collections made in many lakes in January 1980. This particularly broad range was not reached by specimens of the same species in lakes in the Coorong area of South Australia. There the range is 15–38‰ (De Deckker & Geddes 1980). The query concerning the validity of Geddes' (1976) record of the salinity for *A. robusta* in Victoria, made by De Deckker & Geddes (1980, p. 691) is resolved since further work has demonstrated that the salinity range of *A. robusta* definitely differs between Victorian and South Australian lakes. Similarly, Geddes (1976) could not have misidentified *A. robusta* since it is the only *Australocypris* species recorded in his study area.

In Victorian lakes, *A. robusta* is found in a healthy state and in high numbers at salinities between 45 and 77.5‰, and nearly always occurs with *Diacypris compacta* which is found in even higher numbers. At higher salinities, these two species are found with *Platycypris baueri*. *A. robusta* occurs in two permanent salt lakes in Victoria, Lakes Gnotuk and Keilambete, which have salinities in the vicinity of 60‰ the whole year round. This indicates that this species does not necessarily require a sharp decrease in salinity to hatch although Geddes (1976) showed the hatching range for *A. robusta* to be 8.5–108‰.

## SUBFAMILY: CYPRICERCINAE McKenzie 1971

### *Strandesia* Vavra, 1895

*Type species: Strandesia mercatorum* (Vavra, 1895).

### **Strandesia phoenix** n.sp.

FIGS 15 j–q, 16

*Diagnosis: Strandesia* without shell ornamentation, with left valve larger than right valve all along and overlapping it ventrally, except in the anterodorsal area at the extremity of the hinge, where it is overlapped by the right valve; ellipsoid in lateral view and oval with pointed end in dorsal view. Valves asymmetrical when viewed from anterior: greatest extension of right valve at about 0.33 of height from dorsum and of left valve at 0.66.

*Description: Carapace.* (External) Pseudopunctate ellipsoid shell with dorsum and ventrum gently curved, anterior slightly more rounded than posterior which tapers gently; in dorsal view oval with both ends pointed; in anterior view, valves asymmetrical: greatest extension of right valve at about 0.33 of height from dorsum and of left valve at 0.66. Left valve larger than right all along and overlapping it ventrally except in anterodorsal area at extremity of hinge where it is overlapped by right valve normal pores of simple type, some rimmed, others funnel-shaped.

(Internal) Inner lamella broadest anteriorly and almost absent posteriorly in both valves; in left valve flange broad all along except dorsally; inner lamella near outer margin perpendicular to flange in anterior of left

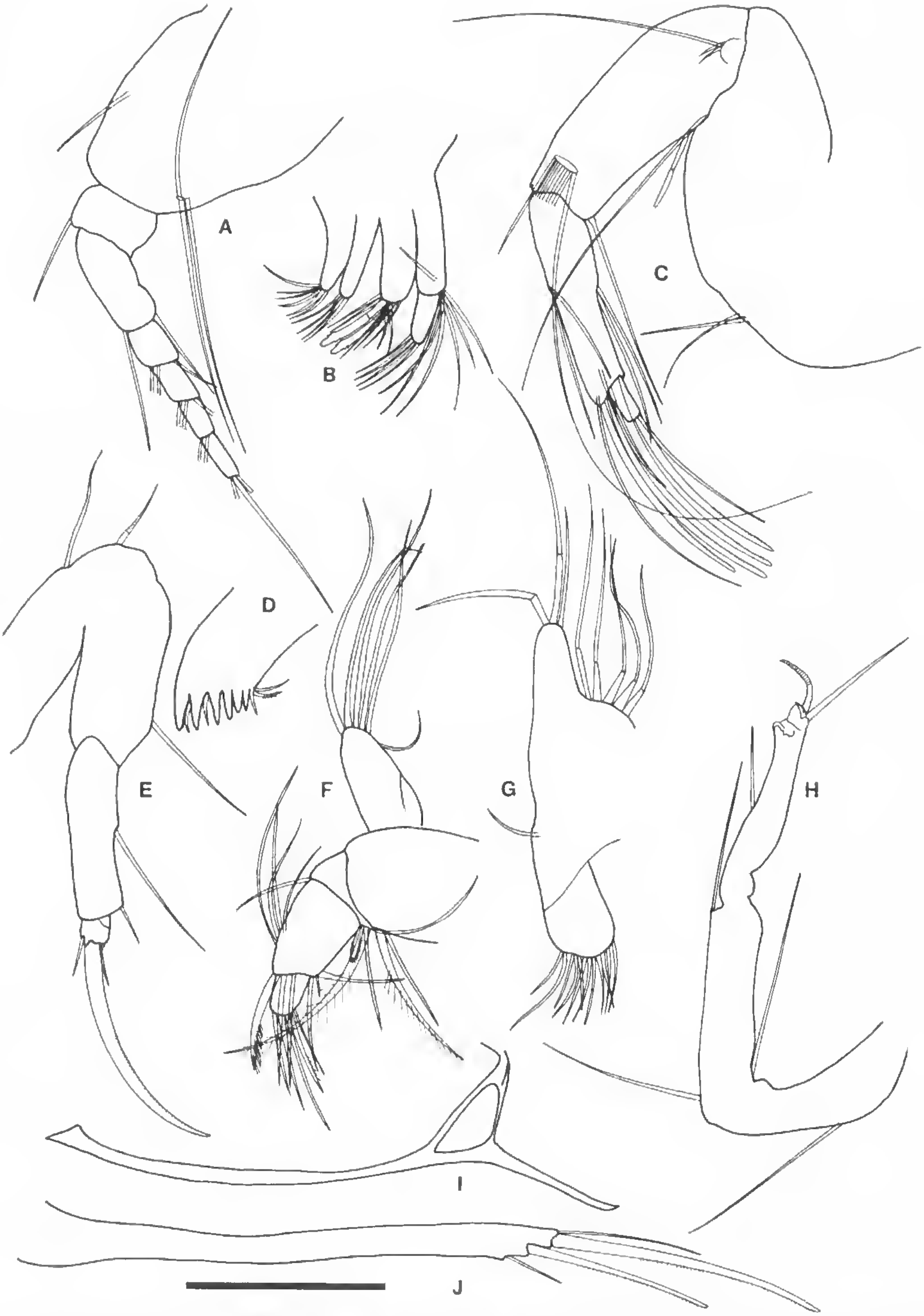

Fig. 16. *Strandesia phoenix* n.sp. a antennula, b maxillula—palp and lobes, c antenna, d mandible—coxale, e thoracopoda I, f mandible—palp, g maxilla, h thoracopoda II, i furcal attachment, j furca. a-j: holotype adult female. Scale: 100μ.

valve and curved inward in its middle; this flat area met by broad selvage of right valve; selvage faint and peripheral in left valve and broad all along in right valve.

*Anatomy:* Antennula: (Fig. 16a) 7-segmented; length/width ratio of last six segments: 1/1.8, 1/4, 1/1, 1.6/1, 2/1, 3/1; natatory setae as long as last six segments together.

Antenna: (Fig. 16c) Four almost equal claws: three on penultimate segment and one on distal segment; natatory setae extending past tip of claws.

Mandible: (Figs 16d,f) Mandibular coxale with seven teeth; distal tooth acicular; epipod with five long and one short Strahlen; distal segment of palp rectangular and with long, slim and barren $\alpha$ bristle, $\beta$ bristle stout and pilose, $\gamma$ bristle thick and twice length of distal segment and pilose on inside of its distal half.

Rake-like organ: Six teeth plus one bifid on inside of each rake.

Maxillula: (Fig. 16b) Length/width ratio of palp segments: 3/1, 3/1; two toothed Zahnborsten on 3rd lobe.

Maxilla: (Fig. 16g) Middle seta more than twice length of other two which are of almost equal length.

Thoracopoda I: (Fig. 16e) First segment with two unequal setae, distal one pectinate and 0.5 length of other; 3rd segment undivided in middle where long seta occurs.

Thoracopoda II: (Fig. 16h) Distal pincers large and distal setae unequal: shortest one curved, with distal half comb-like and 0.5 length of other smooth one; middle seta on last segment less than 0.5 length of all other setae which are of similar length.

Furca: (Fig. 16j) Very long furcal shaft, twice length of longest claw; anterior seta more than twice length of other seta furcal attachment: Median branch narrow and gently curved (fig. 16j) dorsal branch forming eyelet whereas ventral branch straight.

*Colour of shell:* Purple.

*Size:*

holotype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 840μ | 510μ | RV | 860μ | 540μ |

*Type locality:* Coastal dune lake at Evans Head, southwest of Lismore, N.S.W. (29°06′57″S, 152°25′40″E).

*Derivation of name:* From Greek *phoenix* (= purple) for the colour of the shell.

*Ecology and distribution: S. phoenix* has only been collected from the type locality. Water was fresh. No males have been found and no sperms were noticed in the ovigerous females, suggesting that the species was parthenogenetic at that locality.

## SUBFAMILY: DIACYPRIDINAE McKenzie, 1978

### *Reticypris* McKenzie, 1978

*Type species: Reticypris herbsti* McKenzie, 1978.

*Discussion: Reticypris* is an Australian endemic genus which groups the following halobiont species: *R. herbsti* McKenzie, 1978, *R. walbu* De Deckker, 1979, *R. clava* n.sp. and *R. kurdimurka* n.sp. *R. dedeckkeri* McKenzie, 1978, has been synonymized to *R. herbsti* by De Deckker & Geddes (1980) as both taxa have an identical hemipenis (see discussion below). All *Reticypris* species, which are easily distinguishable from one another by the outline of the hemipenis, are discussed below.

### **Reticypris clava** n.sp.

FIGS 17–18

1980 *Reticypris* sp.nov.1, De Deckker & Geddes, p. 692.

*Diagnosis: Reticypris* with lateral lobe of hemipenis crescentic and broadest at base where two lumps are visible on inner side.

*Description: Carapace.* (External) Subrectangular with dorsum gently arched and ventrum almost flat except in mouth region which is concave; anterior broadly rounded and posterior tapering with posterodorsal area inclined; slight depression at extremity of hinge anteriorly; left valve slightly larger all along and overlapping right valve in mouth region dorsally, especially where slight depression occurs; surface of shell with small, dense reticulation usually all over and thickness of reticulation variable; outer flange close to outer margin, narrow and thinly denticulated except in mouth region where it is straight; greatest height at about 0.4 from anterior; in dorsal view like a flattened oval and both extremities slightly pointed. Normal pore canals of simple type and rimmed.

(Internal) Inner lamella equal in both valves and broadest anteriorly, tapering to 0.66 of the width posteroventrally. Hinge consists of broad

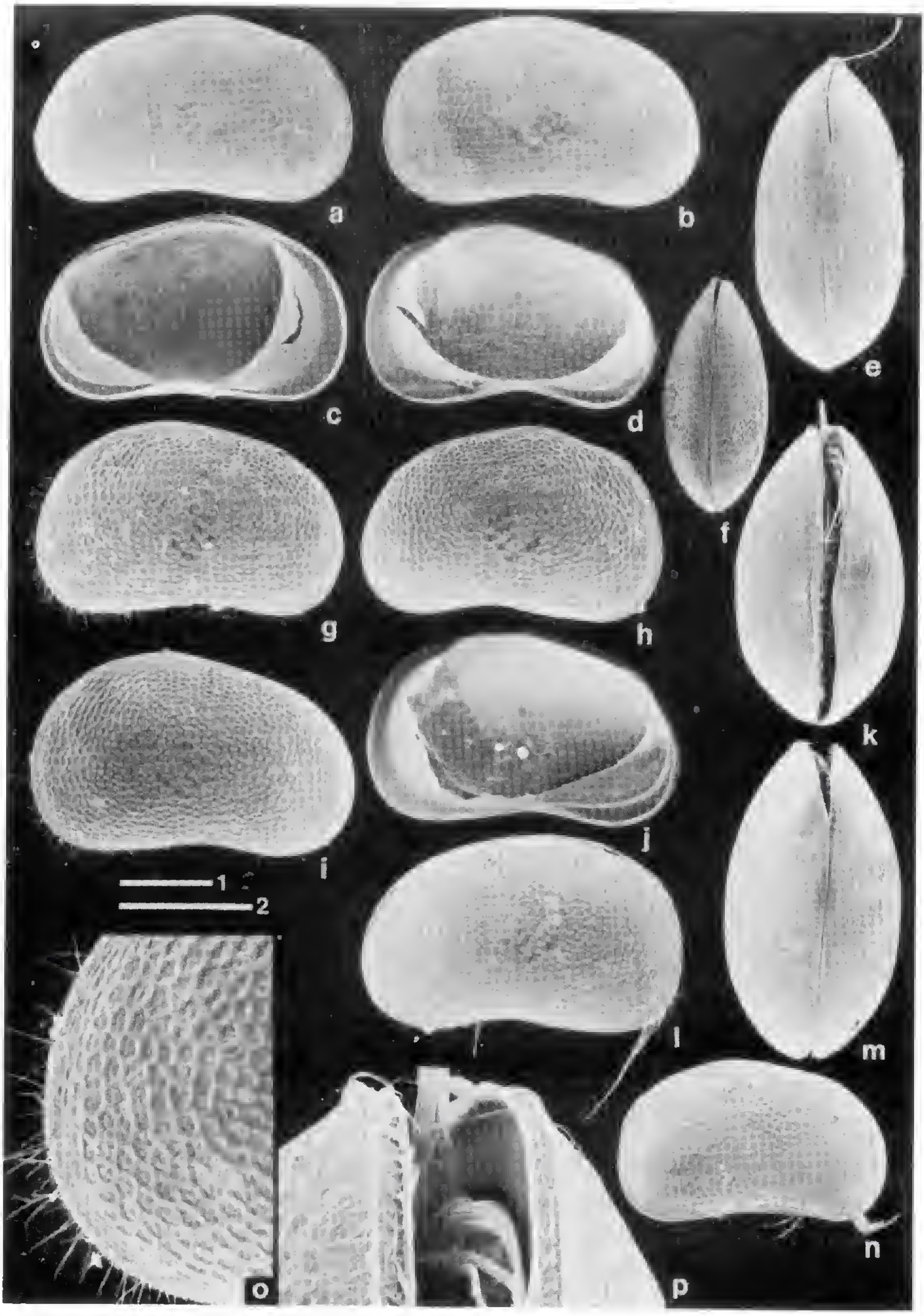

Fig. 17. *Reticypris clava* n.sp. a RV external, b LV external, c LV internal, male paratype. d RV internal, male paratype. e C dorsal, male paratype. f C dorsal, male. g LV external, female paratype. h RV external, female paratype. i LV external, female paratype. j RV internal, female paratype. k C ventral, female paratype. l C showing RV, female paratype. m C dorsal, female paratype. n C showing LV, male. o LV external, anterior detail of i. p C ventral, anterior detail of k. a-e, g-m, o-p: Type locality; f, n: Lake Weeranganuk, Vic. Scale: 1—200μ for a-n; 2—100μ for o;—50μ for p.

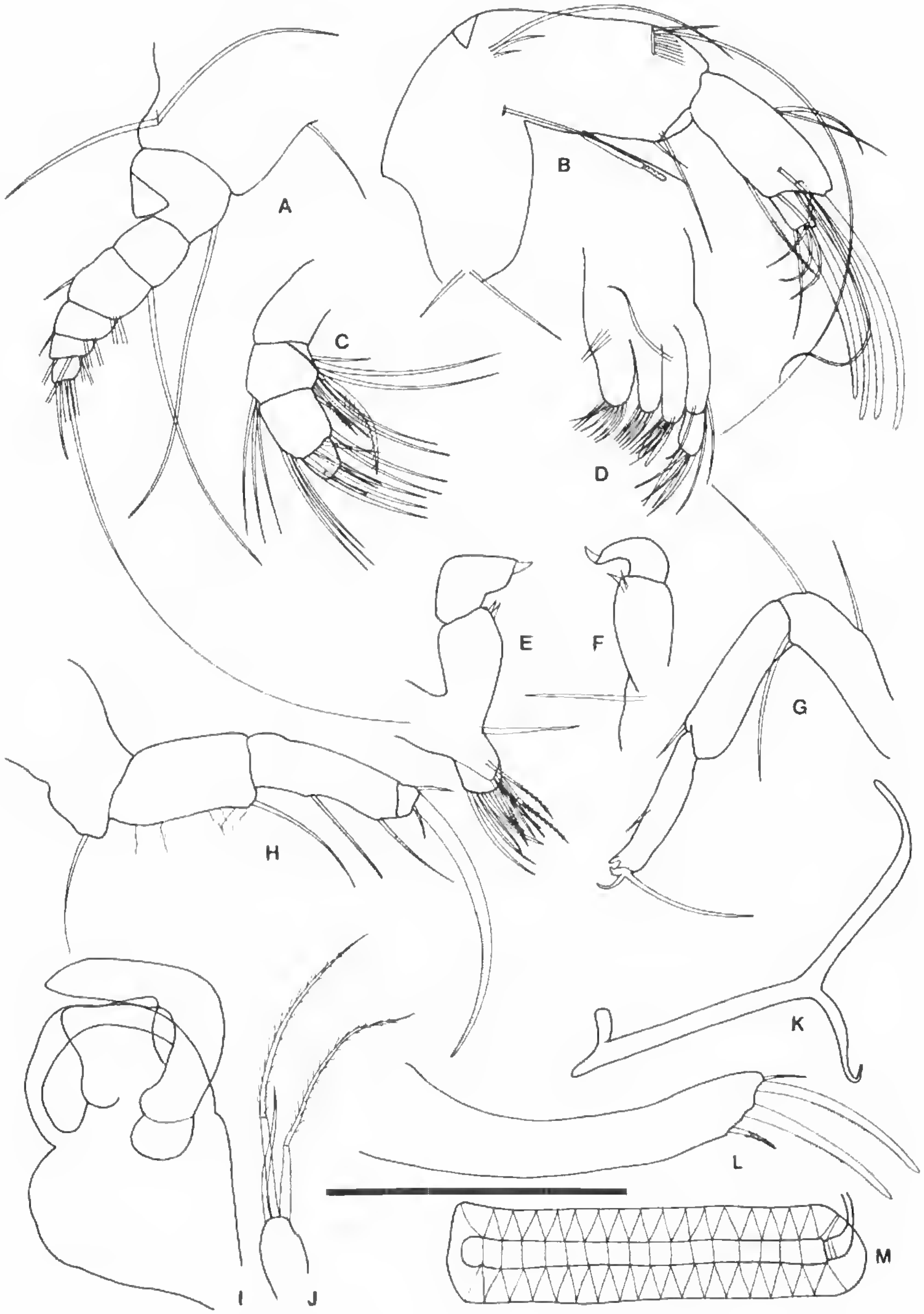

Fig. 18. *Reticypris clava* n.sp. a antennula, b antenna, c mandible palp, d maxillula, palp and lobes, e maxilla, male, f maxilla, endopodite, male, g thoracopoda II, h thoracopoda I, i hemipenis, j maxilla—endopodite, female, k furcal attachment, l furca, m Zenker organ. a-i, k-m: holotype adult male; j: paratype adult male. Scale: 100$\mu$.

groove in left valve in which interlocks right valve; radial pore canals numerous and straight.

*Anatomy:* Antennula: (Fig. 18a) 7-segmented; length/width ratio of last six segments: 1/1.5, 1/1, 1/1, 1/1.8, 1/2, 1/1; natatory setae slightly longer than all segments together.

Antenna: (Fig. 18b) Three long and equal claws on penultimate segments with shorter claw on distal one which is pectinate in male; natatory setae extending past tip of claws.

Mandible: (Fig. 18d) Seven teeth on mandible coxale: last one longer than other three adjacent to it and, near its base, two short pilose setae; length/width ratio of palps: 4.5/1, 1.7/1; 3rd lobe has two smooth Zahnborsten; epipod with five plumose Strahlen and a smaller barren one.

Rake-like organ: Eight teeth with an additional bifid one on inner side.

Maxillula: (Fig. 18c) Distal segment squarish; $\alpha$, $\beta$ and $\gamma$ bristle of equal length and slim: $\alpha$ smooth, $\beta$ pectinate, $\gamma$ smooth.

Maxilla: Sexually dimorphic: in male, palps asymmetrical (Figs. 18e,f): broadest forming right angle on outside whereas other more arched; in female (Fig. 18j) setae unequal with shortest smooth whereas other two plumose; for chaetotaxy of protopod see Fig. 18e.

Thoracopoda I: (Fig. 18h) Penultimate segment undivided and all inner setae long and of about equal length.

Thoracopoda II: (Fig. 18g) Distal pincers small and distal setae unequal: shorter one curved and 0.25 length of other.

Hemipenis: (Fig. 18i) Lateral lobe crescent-shaped and broadest at the base where two lumps are visible on inner side; inner lobe squarish with three sides concave.

Zenker organ: (Fig. 18m) Elongated with 16 rosettes.

Furca: (Fig. 18l) Pectinate claws thick and equal; setae equal, pectinate and 0.33 length of claws.

Furcal attachment: (Fig. 18k) Median branch straight and of about same length as curved inward dorsal branch; ventral branch forming obtuse angle with dorsal one and hook-shaped distally; short rod-like, extension at right angle on base of median branch.

Eye: Cups of nauplius eye fused.

*Colour of shell:* Light green to white.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 700μ | 430μ | RV | 690μ | 430μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 720μ | 445μ | RV | 700μ | 440μ |

*Type locality:* Ephemeral salt lake S of the Coorong Lagoon, S.A. (36°13′36″S, 139°41′29″E) = locality 3 of De Deckker & Geddes (1980).

*Derivation of name:* From Latin *clava* (= club) for the diagnostic shape of the outer lobe of the hemipenis.

*Ecology and distribution:* In collections from western Victorian lakes, *R. clava* was always accompanied by low salinity ostracods such as *Mytilocypris splendida* or *M. praenuncia*, and occasionally with *D. spinosa*. Salinity for these collections ranged between 4 and 42‰. In the lakes adjacent to the Coorong Lagoon in South Australia, the salinity range for *R. clava* is 5–131‰ but it was never found in high numbers above 68‰. Only in one lake near the Coorong Lagoon (locality 7 of the De Deckker & Geddes 1980) was *R. clava* found together with *R. herbsti*—this co-occurrence persisted throughout the year. *R. clava* has been collected once in Western Australia between 14.6 and 59.5‰ (Geddes *et al.* 1981).

*Remarks:* It is difficult to distinguish *R. clava* and *R. herbsti* on features of the shell as reticulation of the shell and even shape and size are known to vary (see Fig. 17 for *R. clava*). The outline of the hemipenis is a good diagnostic feature for separation of the two species.

### *Reticypris herbsti* McKenzie, 1978

1978 *Reticypris herbsti* n.sp., McKenzie, p. 188.

*Diagnostic: Reticypris* with lateral lobe of hemipenis boot-shaped.

*Description:* See McKenzie (1978), p. 188–9.

*Ecology and distribution: R. herbsti* is tolerant to higher salinities than *R. clava*. In western Victorian lakes it was found with *D. compacta* at salinities between 99 and 172‰ whereas, in the lakes near the Coorong Lagoon, it occurred at salinities between 12 and 141‰ with three supplementary records at 195, 216 and 218‰. It is found in high numbers between 104 and 124‰ salinity.

In a number of specimens, collected in lakes near the Coorong Lagoon, specimens with thin and faintly reticulated shell were seen, whereas others were thicker with a coarse reticulation. Similarly, a ventral ridge was occasionally associated with a coarsely reticulated shell, or also with juveniles. The ecological significance of these differences is not known.

### **Reticypris kurdimurka** n.sp.

FIGS 19–20

*Diagnosis: Reticypris* with outer lateral lobe of hemipenis spout-shaped and copulatory sheath heart-shaped.

*Description: Carapace.* (External) Subrectangular to squarish in lateral view with both valves usually thick; reticulation resembles broad punctation; anterior and posterior similar and broadly rounded; ventrum flat except in mouth region where it is concave dorsum arched or depressed in front of point of greatest height, and at 0.33 from anterior, and behind it, it slopes gently; outer lamella thin and peripheral; left valve slightly larger all around and in some specimens overlap of left valve over right one is obvious, at both extremities of the hinge, as it forms smooth elongated humps.

(Internal) Inner lamella slightly broader anteriorly compared to posteroventral area; selvage faint and peripheral in right valve whereas at a distance from outer margin in left valves; radial pore canals narrow and straight; hinge consists of a broad groove in left valve in which right valve interlocks.

*Anatomy:* Antennula: Fig. 20a) 7-segmented length/width ratio of last six segments: 1/1.25, 1/1, 1/2.5, 1/2, 1/2, 1/1; natatory setae longer than all segments together.

Antenna: (Fig. 20b) Three equal long claws on penultimate segment; 4th claw on distal segment reaching tip of other claws and pectinate in male, whereas it is shorter and with smaller teeth in female; natatory setae reaching tip of claws.

*Mandible:* (Fig. 20h) Mandibular coxale with seven teeth; palp with distal segment squarish, α bristle short, slim and smooth β bristle short, stout and pilose, γ bristle twice length of distal segment and pilose in its distal half.

Rake-like organ: Eight teeth with an additional inner one which is bifid.

Maxillula: (Fig. 20c) Distal palp almost squarish and 3rd lobe with two smooth Zahnborsten.

Maxilla: Sexually dimorphic: in male (Figs 20e,f) almost symmetrical: one slightly more arched and narrower than other; in female (Fig. 20g) three smooth setae, middle one being more than twice length of other two which are equal.

Thoracopoda I: (Fig. 20d) 3rd segment undivided; inner setae small and unequal.

Thoracopoda II: (Fig. 20i) As for *R. clava.* Hemipenis: (Figs. 20k,l) Lateral lobe spout-shaped and broadest at mid-length; copulatory sheath heart-shaped.

Zenker organ: (Fig. 20n) Elongated with 11 rosettes.

Furca: (Fig. 20m) Claws equal and thick; setae equal and small, about 0.25 length of claws.

Furcal attachment: (Fig. 20j) Median branch and long dorsal one gently curving; ventral branch forming a right angle with dorsal branch and forming a loop distally; vertical rod-like extention near base of median branch.

Eye: Cups of nauplius eye fused.

*Colour of shell:* White when preserved in alcohol.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 565μ | 350μ | RV | 560μ | 330μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 600μ | 400μ | RV | 590μ | 375μ |

*Type locality:* Madigan Gulf, Lake Eyre, South Australia.

*Derivation of name: Kurdimurka* is an aboriginal name for a legendary creature supposed to inhabit the bottom of lagoons and creeks in the Lake Eyre district.

*Ecology and distribution:* One specimen of *R. kurdimurka* had been originally collected from Lake Eyre North on 28.IV.1975 at about 40‰ salinity when the lake was last flooded (see Bayly 1976, p. 664 where it is referred to as "undescribed cypridid genus"). Subsequently, it has been collected twice from Madigan Gulf, at Lake Eyre by W. Zeidler on 11.XII.1974 and 2.XII.1975—no salinity records for these collections are available. Recently, the same species was collected from Lake Annean, 40 km S of Meekatharra, in W.A., at 21.3‰ salinity (see Geddes *et al.*, in press). The Western Australian specimens had a much thinner shell than those from Lake Eyre.

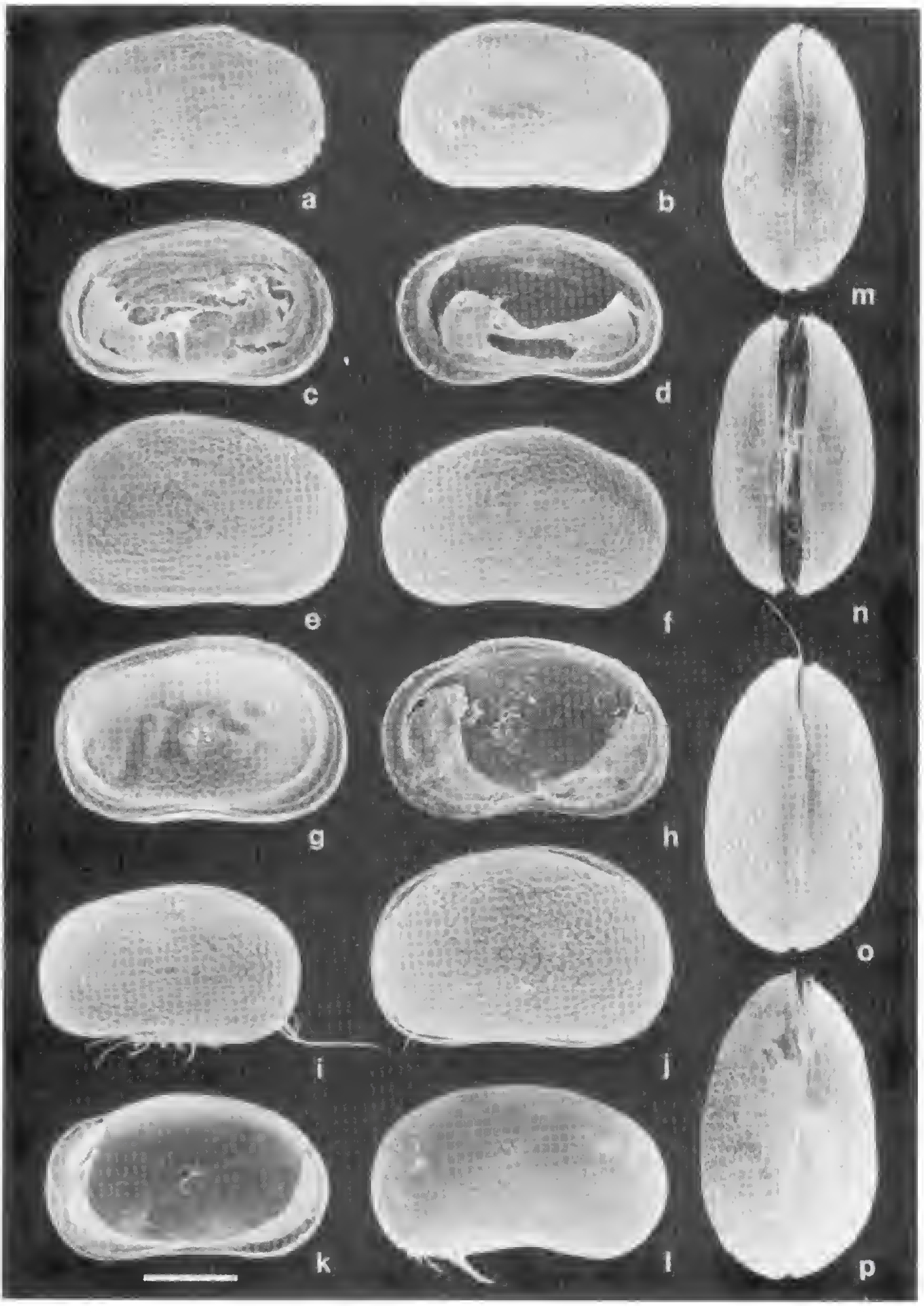

Fig. 19. *Reticypris kurdimurka* n.sp. a RV external, male holotype. b LV external, male holotype. c LV internal, male paratype. d RV internal, male paratype. e LV external, female paratype. f RV external, female paratype. g LV internal, female paratype. h RV internal, female paratype. i C showing RV, male paratype. j C showing RV, female paratype. k RV internal, male. l C showing LV, male. m C dorsal, male paratype. n C ventral, male paratype. o C dorsal, female paratype. p C dorsal, male. a-j, n-o: Type locality; k-l, p: Lake Annean, 40 km S of Meekatharra, W.A. Scale: 200μ.

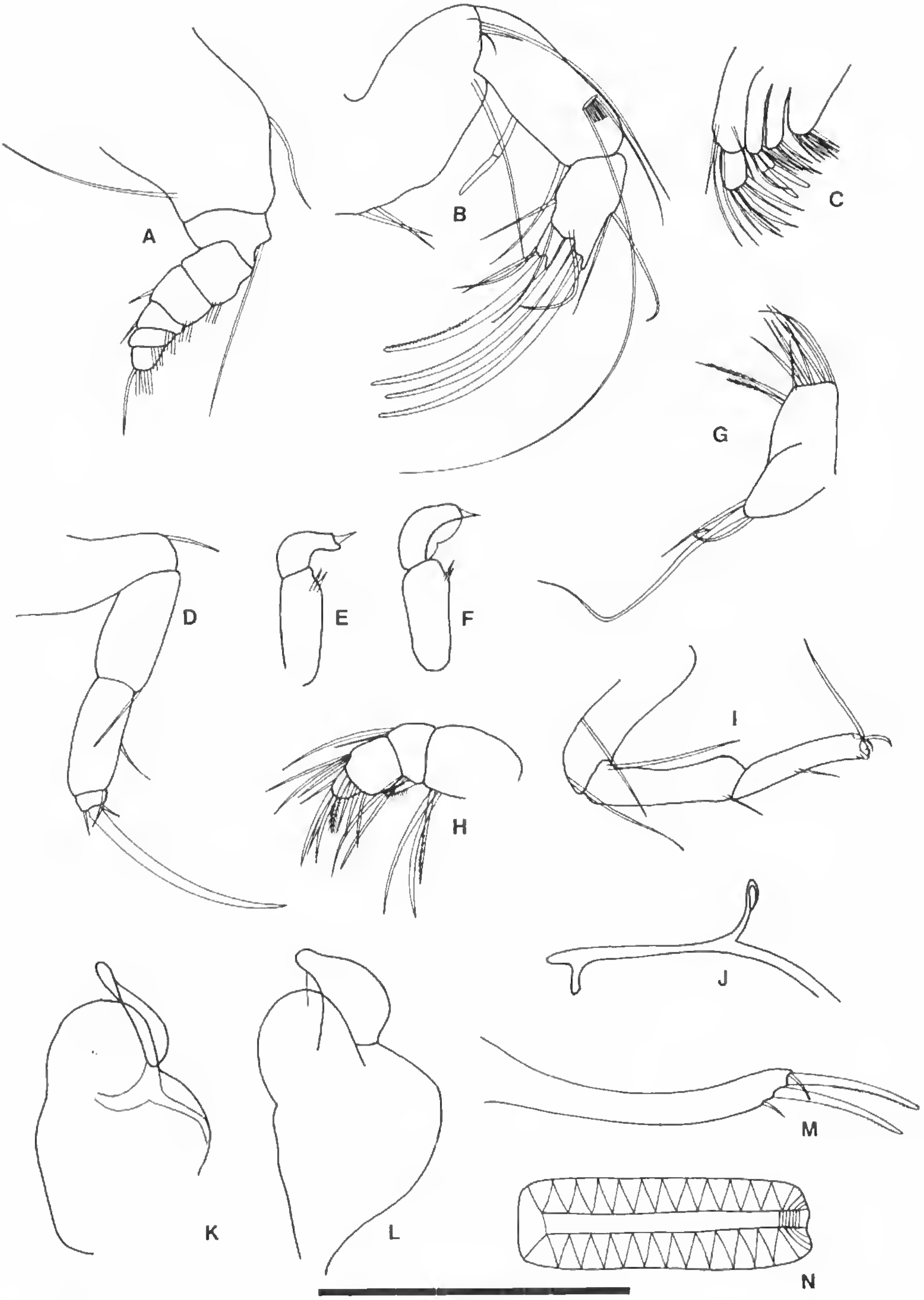

Fig. 20. *Reticypris kurdimurka* n.sp. a antenna, b antennula, c maxillula—palp and lobes, d thoracopoda I, e maxilla—endopodite, male, f maxilla—endopodite, male, g maxilla, female, h mandible—palp, i thoracopoda II, j furcal attachment, k hemipenis, l hemipenis, m furca, n Zenker organ. a-b, d-f, h-n: holotype adult male; c, g: paratype female. Scale: 100μ.

### *Reticypris walbu* De Deckker, 1979

1979 *Reticypris walbu* De Deckker, p. 162.

*Diagnosis: Reticypris* with lateral lobe of hemipenis banana-shaped and inner lobe cudgel-shaped.

*Description:* See De Deckker (1979) p. 162–4.

*Discussion: R. walbu* was originally described from samples collected in mound springs between Strangways and Curdimurka, near Lake Eyre South in South Australia. Since then it has been recognized from a collection made by I. A. E. Bayly and W. D. Williams in Lake Buchanan, S.W. of Charters Tower in Queensland, in January 1965. Water salinity was 87.6‰ (Bayly & Williams 1973). It has not been found in subsequent collections made at the same lake by B. V. Timms. Similarly, it is surprising that *R. walbu* has not been collected in Lake Eyre instead of *R. kurdimurka*. Such patchy distribution remains unexplained.

## FAMILY: ILYOCYPRIDIDAE Kaufmann, 1900

### *Ilyocypris* Brady & Norman, 1889

*Type species: Ilyocypris gibba* (Ramdohr, 1808).

### *Ilyocypris australiensis* Sars, 1889

1889 *Ilyocypris australiensis* Sars, p. 46.

FIG. 21

*Diagnosis: Ilyocypris* with club-shaped inner lobe on hemipenis extending to as much as 0.66 of length of trapezoid lateral lobe.

*Remarks:* The original description of *I. australiensis* by Sars (1889a) is sufficient, and does not warrant additional illustrations of the anatomy here. The ornamentation and outline of the valves of *I. australiensis*, however, are extremely variable. Typical variations are illustrated in Fig. 21 (all SEM photos are at the same scale and only adults are represented). The surface of the shell can be finely (Fig. 21l) to coarsely pitted (Figs 21e,f,o); acicular but small spines occur, mostly posterodorsally (Figs. 21h,i) when present, but can also cover the entire carapace (Fig. 21o). The outline of the shell is also variable anteriorly and dorsally. In dorsal view, anteriorly the shell can be pointed (Figs 21j,o) or with a squarish blunt end (Figs 21m,n). The latter feature is often accompanied by a depression bordering the periphery of the valve anteriorly and posteriorly (Figs 21a,d). Depressions are also variable dorsally, a circular one above the central muscle field and the other vertical above and in front of the central muscle field.

The ecological significance of all these variations are not yet understood but this is not a surprising phenomenon since *I. australiensis* is commonly found in temporary pools which are renowned as the sites of broad variations in physical parameters (viz. temperature, pH, $O_2$). *I. australiensis* can swim but is usually found crawling in or above muddy substrates in ponds. The species usually occurs in ponds which retain water for a few months and which have a very soft substrate. *I. australiensis* has also been collected in a number of shallow and slightly saline lakes in western Victoria. These lakes are characterized by small fluctuations in salinity over the year. This explains the absence of *I. australiensis* in the saline lakes near the Coorong Lagoon studied by De Deckker & Geddes (1980) where salinity of some lakes was close to fresh in winter, but rose rapidly during spring and summer months. In western Victoria, the range of salinity tolerance of *I. australiensis* is usually 4–7‰ with one record at 10.37‰ in Lake Kariah. So far, *I. australiensis* has never been collected in deep lakes (fresh or slightly saline) nor in permanent fresh lakes.

*I. australiensis* has been collected all across Australia. It is also recorded from North Africa (Gauthier 1928), Asia and southern Europe (Hartmann 1964, p. 148).

As the morphology of the hemipenis of *I. australiensis* and *I. decipiens* Masi, 1906, as illustrated in Petkovski (1958), is almost identical, it is suggested here that these two species could be synonymous. Further work is necessary to confirm this hypothesis, but it is important to be aware of the variation in shell ornamentation of the *Ilyocypris* species as illustrated above, and by Diebel and Pietrzeniuk (1975) for *I. bradyi* Sars, 1890, since many *Ilyocypris* species are separated on shell morphology alone. The selection of particular features of the shell as taxonomically important by van Harten (1979) will not prove to be useful for *I. australiensis* specimens since for example, the "marginal ripplets" of van Harten are variable in Australian specimens, and even occasionally absent. Further, distinction of species on features other than

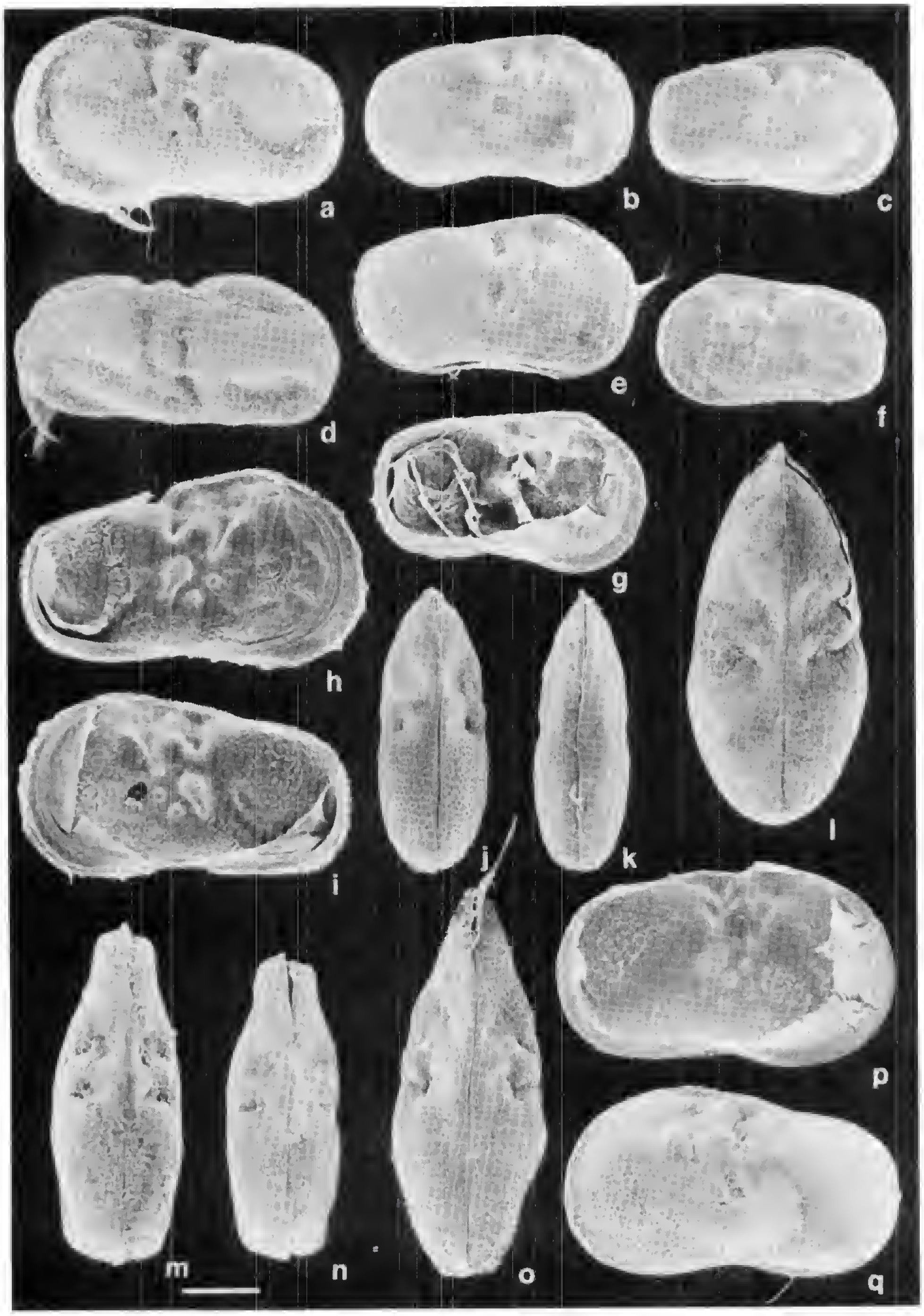

Fig. 21. *Ilyocypris australiensis* Sars, 1889. a C showing LV, female. b RV external, male. c C showing RV, female. d C showing LV at dorsolateral view, male. e C showing RV, male. f C showing LV, male. g LV internal, male. h LV internal, female. i RV internal, female. j C dorsal, female. k C ventral, male. l C dorsal, female. m C dorsal, female. n C dorsal, male, same specimen as d. o C dorsal, female. p LV internal, female. q C showing LV, male. a, d, h-i, m: Pool in creek bed at 25 km N of Cue, W.A. b, e, g, j-k: Martin Lake Vic. c, f: in vent to Warrawenia Lake, N.S.W.; l, p-q: Pool in creek bed, 12 km S of Menzies, W.A.; o: Pond very close to Reel Inlet (coastside) 19 km S of Mandurah, W.A. Scale: 200$\mu$.

the hemipenis is likely to be unreliable since the morphology of many appendages of *Ilyocypris* species are known to vary. For example, Gauthier (1928) discussed the variations in the anatomy of *I. australiensis* and *I. biplicata* (Koch, 1838) from North Africa and concluded that he was incapable of separating the species, although neither was he prepared to synonymize them.

### **Ilyocypris perigundi** n.sp.

FIGS 22–23

*Diagnosis: Ilyocypris* with carapace trapezoid; anterodorsal area at hinge extremity compressed and forming a hump when viewed laterally; three large protuberances in dorsal area, posterior one being largest, pustulose and ending with a number of wart-like tubercles; ventrum concave and at 0.6 from anterior. Club-shaped inner lobe of hemipenis reaching tip of trapezoid lateral lobe.

*Description: Carapace.* (External) Trapezoid with greatest height 0.2 from anterior where hinge starts; dorsum straight except at point of greatest height where both valves form flattened hump; ventrum concave at 0.6 from anterior. Surface of shell highly ornamented: three protuberances dorsally with posterior one largest and ending with broad wart-like tubercles from which seta protrudes; below posterior protuberance and above ventrum, is an additional highly ornamented protuberance: this is point of greatest width of shell; deep depression dorsally between middle and posterior protuberances; shell covered with broad pseudopunctae which are pustulose inside; pointed tubercles along margin anteriorly and posteriorly. Dorsally, shell like flattened ellipsoid with anterior compressed and pointed for width of inner lamella but tapering posteriorly.

(Internal) Inner lamellae twice as wide in anterior compared to posterior in both valves; narrow selvage at 0.66 from outer margin anteriorly and peripheral to inner margin posteriorly; marginal ripplets broad in left valve posteroventrally.

*Anatomy:* Antennula: (Fig. 23c) 6-segmented; length/width ratio of last five segments: 5/3, 1.2/1, 1.3/1, 2/1, 4/1; natatory seta as long as all segments together.

Antenna: (Fig. 23a) Natatory setae twice length of last two segments and claws together; three long distal claws on penultimate segment plus another as long as other three on last segment with a narrower and shorter one.

Mandible: (Fig. 23d) Length/width ratio of last two segments of mandibular palp: 4/3, 1/1.

Maxillula: (Fig. 23b) Distal segment of palp trapezoid and ending with three broad long setae plus two shorter ones; no Zahnborsten on 3rd lobe but setae short and stout on all three lobes.

Maxilla: Sexually dimorphic: in male (Figs. 23e,h) palps two or three-jointed with one seta at the distal end of the 1st segment; in female (Fig. 23g) non-segmented, short and narrow palp with three unequal setae. For chaetotaxy see Figs 23g,h; epipod plate with five Strahlen.

Thoracopoda I: (Fig. 23f) Last segment undivided; all setae short.

Thoracopoda II: (Fig. 23i) 4-segmented with three distal setae, two long equal ones and 3rd about 0.66 length of others.

Hemipenis: (Figs 23j,k) Outer lobe trapezoid with inner distal end pointed which is nearly reached by long club-shaped inner lobe; outer lobe triangular with distal end rounded and slightly pinched laterally; inner lobe 0.33 length of others.

Zenker organ: (Fig. 23l) Both ends of globular and with 13 rosettes.

Furca: (Fig. 23m) Two long equal claws; posterior setae slightly longer than anterior and placed at 0.4 of length of shaft from posterior claw.

*Colour of shell:* Transparent white.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 580μ | 365μ | RV | 560μ | 355μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 580μ | 380μ | RV | 580μ | 350μ |

*Type locality:* Warrawenia Lake, south of Menindie, N.S.W. (33°29'30"S, 141°44'30"E)

*Derivation of name:* From the aboriginal language *perigundi* meaning meandering lake or lagoon, as this species has been found in a lake part of an old river system (Warrawenia L.) and in a lagoon (Katarapko L.).

*Ecology and distribution:* This species has only been collected in three localities: Warrawenia L., Katarapko Lagoon, which is a natural billa-

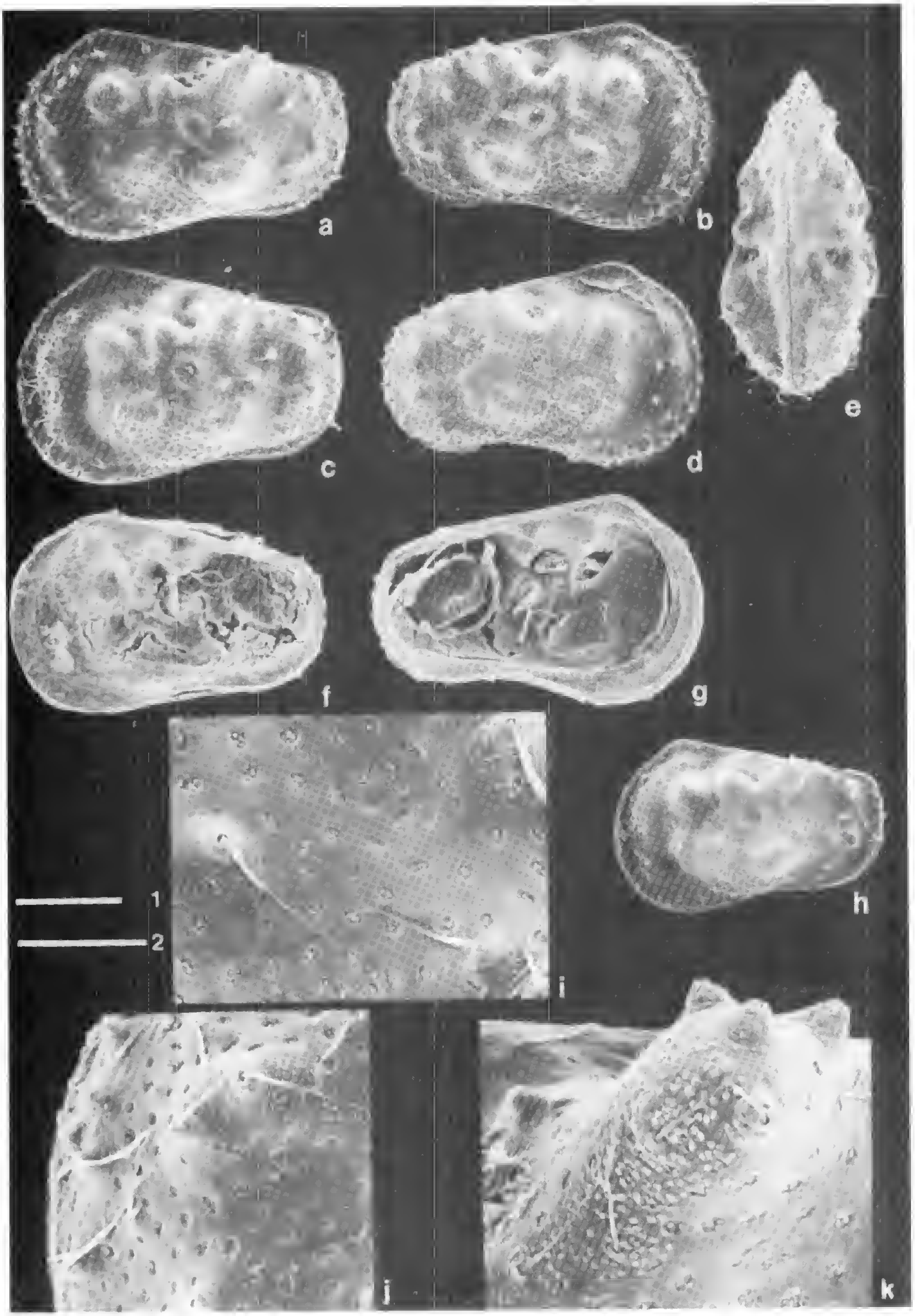

Fig. 22. *Ilyocypris perigundi* n.sp. a LV external, female paratype. b RV external, female. c LV external, female. d external, male holotype. e C dorsal, female paratype. f RV internal, female paratype. g LV external, male holotype. h LV external, juvenile. i LV external, detail of a. j LV external, posterior detail of C. k LV external, dorsal detail of a. a,d-g, i-k: Type locality; b-c, h: Katarapko Lagoon, near Loxton, S.A. Scale: 1—200μ for a-h; 2—50μ for i-k.

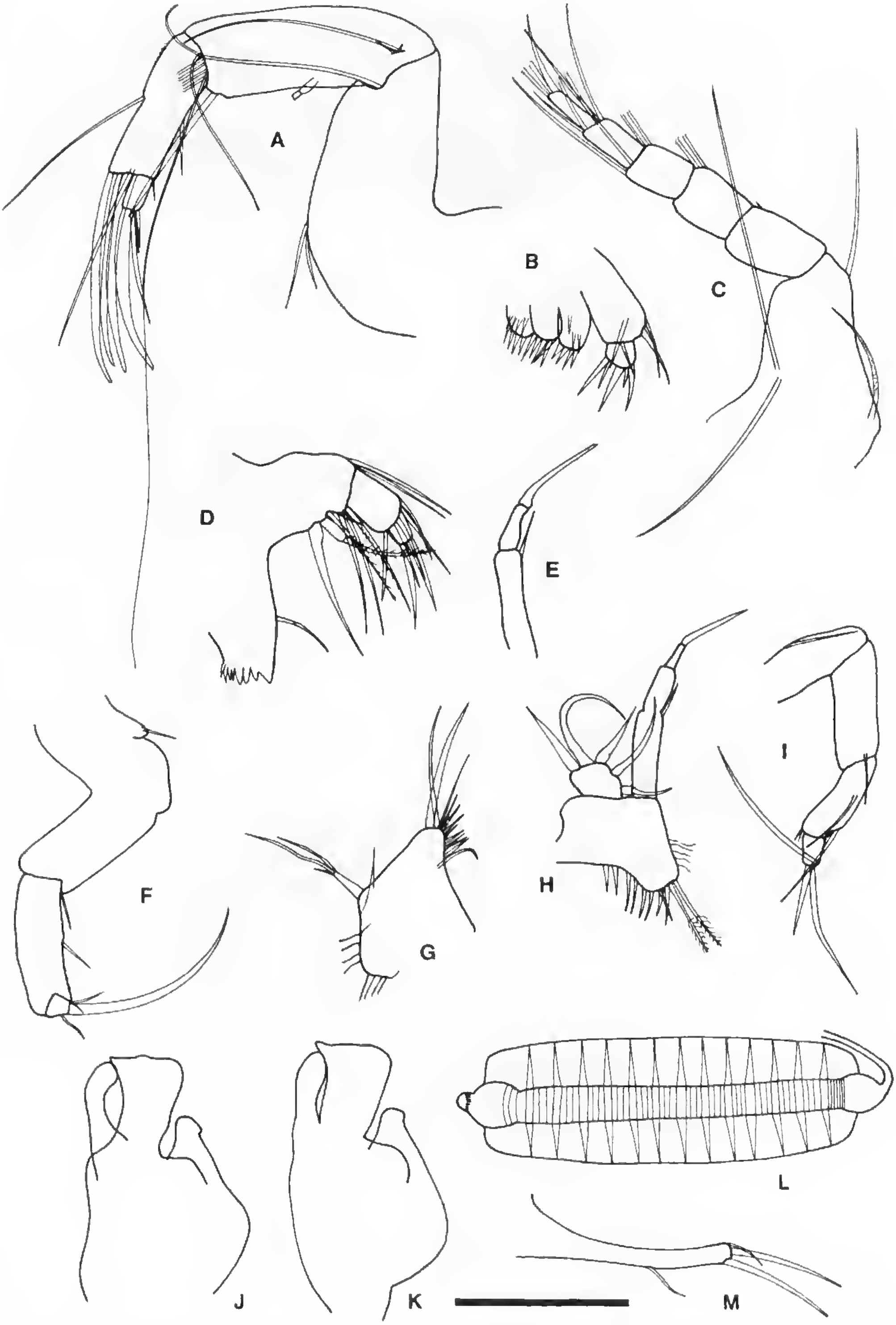

Fig. 23. *Ilyocypris perigundi* n.sp. a antenna. b maxillula—palp and lobes. c antennula. d mandible. e maxilla—endopodite, male. f thoracopoda I. g maxilla, female. h maxilla, male. i thoracopoda II. j hemipenis. k hemipenis. l Zenker organ. m furca, a-f, h-m: holotype adult male. g: paratype adult female. Scale: 100μ.

bong converted into an evaporative basin near the River Murray at Loxton, S.A., and from Scott Creek, near Adelaide At all three localities only a few specimens have been collected; most specimens were coated with mud particles. The salinity at Katarapko Lagoon was 3‰. Salinity of the water from the type locality has not been measured. At Scott Creek, water was fresh.

*Remarks: I. perigundi* differs from *I. austroliensis* on the following features: the former is smaller and has a very different shell architecture characterized by the three highly ornamented dorsal protuberances, a ventrum placed at 0.66 from the anterior of the shell and a flat dorsal hump in the extremity of the hinge anteriorly. The inner lobe of the hemipenis in *I. perigundi* is almost as long as the lateral lobe whereas it is only 0.66 the length in *I. australiensis*.

## SUPERFAMILY: CYTHERACEA Baird, 1850

## FAMILY: LEPTOCYTHERIDAE Hanai, 1957

### *Leptocythere* Sars, 1925

*Type species: Leptocythere pellucida* (Baird 1850)

### **Leptocythere lacustris** n.sp.

FIGS 24–25

1919 *Cythere lubbockiana* Brady: Chapman, p. 29.

*Diagnosis: Leptocythere* with deeply pitted external surface of shell, large circular depression posteroventrally outside and where inner lamella is broadest on inside; posterodorsally near termination of hinge, shell is slightly concave and posterior to it; shell thick and smooth especially in left valve. Outline of hemipenis as in Figs 25j,k.

*Description: Carapace.* (External) Subrectangular shell, coarsely pitted and with at least two elongated grooves; anterior straight and forms an obtuse angle with hinge line and other, at posterior, runs almost parallel to curvature of shell; a deeper and broader notch often visible in posteroventral area in both valves; ornamentation of shell varying from fine to coarse ribbing; dorsum almost straight and inclined except in postero-dorsal area, just before termination of hinge where it is slightly concave; behind this, shell thick and smooth, especially in left valve; greatest height at about 0.25 from anterior; mouth region concave and at 0.4 from anterior. In dorsal view, shell compressed and has almost straight sides except where grooves occur anteriorly and posteriorly; hinge area almost smooth externally.

(Internal) Inner lamella broad and widest in posteroventral area opposite external deep notch; selvage faint and peripheral in both valves; hinge crenulated all along with broad tooth at both ends in right valve and matching sockets in left one; behind anterior socket in left valve, are two smaller teeth and in front of the posterior socket, with a matching depression in right valve, is also a small tooth; central muscle field with vertical row of four scars: two in middle are elongated and parallel to hinge line whereas others are almost circular.

*Anatomy:* Antennula: (Fig. 25a) 6-segmented; length/width ratio of last four segments: 1.6/1, 1/1.4, 1/1 to 1.4/1, 4/1; distal thick seta pectinate.

Antenna: (Fig. 25b) Two smooth distal claws on terminal segment slightly shorter than inner claw near distal end of penultimate segment.

Mandible: (Figs 25d,e) Mandibular coxale with seven teeth and long acicular seta on inner side near base of smaller tooth; epipod with terminal segment small and square-shaped.

Maxillula: (Fig. 25c) Epipod with 14 long and short Strahlen; terminal segment of palp small, rectangular and with one distal seta jointed.

Maxilla: (Figs 25h,i) Distal claw short and slightly curved; in female inner seta on 2nd segment pilose in its distal half (Fig. 25i) whereas barren in male (Fig. 25h).

Thoracopoda I: (Fig. 25f) Slightly larger than maxilla but with only one distal seta on 1st segment.

Thoracopoda II: (Fig. 25g) Similar but slightly larger than thoracopoda I and with distal claw more slender.

Hemipenis: See outline in Figs 25j,k.

Genitalia: See outline in Fig. 25m.

Furca: (Figs 25k,m) One long seta near hemipenis and genital organ.

End of body: (Fig. 25l) With one small seta and densely pilose

*Colour of shell:* Light brown.

*Size:*

holotype adult male

|  | L | H |  | L | H |
|---|---|---|---|---|---|
| LV | 500μ | 270μ | RV | 490μ | 270μ |

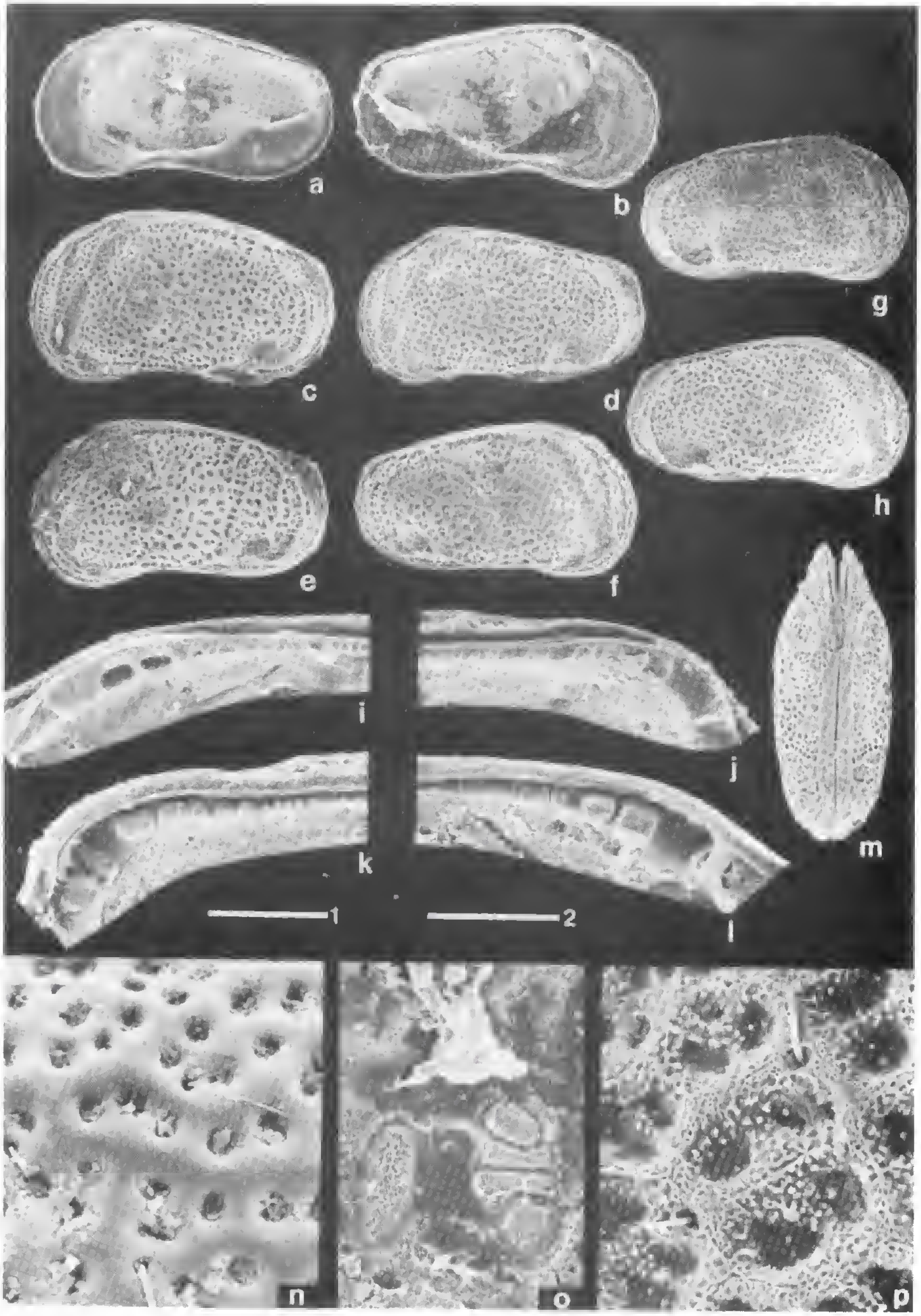

Fig. 24. *Leptocythere lacustris* n.sp. a RV internal, male holotype. b LV internal, male holotype. c C showing LV, female paratype. d LV external, male paratype e LV external female paratype. f C external showing RV, male paratype. g C external showing RV, male. h RV external, male paratype. i RV internal, hinge posterior detail of a. j RV internal, hinge posterior detail of a. k LV internal, hinge posterior detail of b. l LV internal, hinge anterior detail of b. m C dorsal, male paratype, n C external, detail of g. o RV internal, detail central muscle field of a. p LV external, detail of e, e-f, h-m, o-p: Type locality; g, n: Chara Lake, near Robe, S.A. Scale: 1—200$\mu$ for a-h, m; 2—50$\mu$ for i-l, o;—25$\mu$ for n.p.

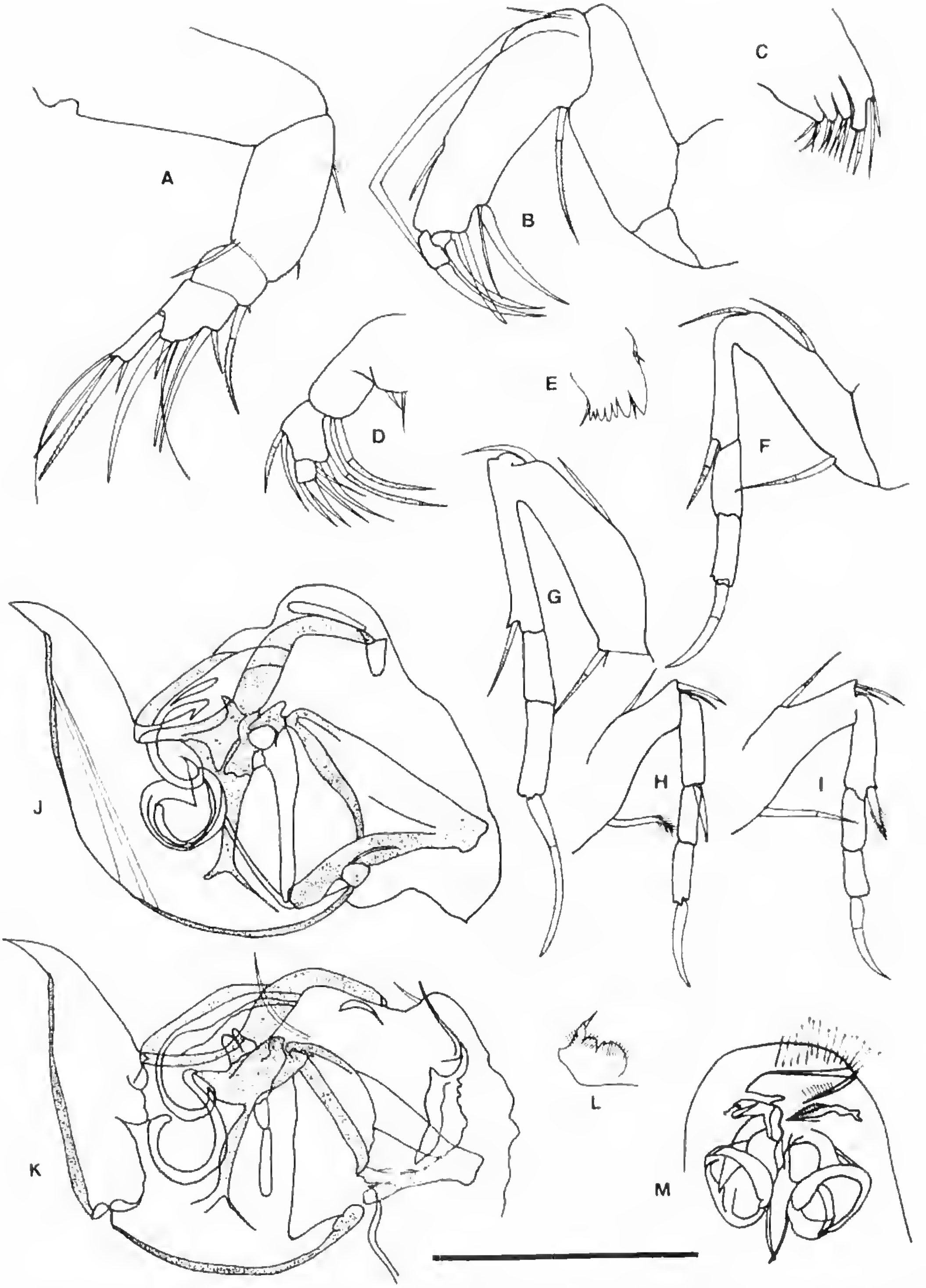

Fig. 25. *Leptocythere lacustris* n.sp. a antennula. b antenna. c maxillula—palp and lobes. d mandible—palp and lobes. d mandible—palp. e mandible—coxale. f thoracopoda I. g thoracopoda II. h maxilla, male. i maxilla, female. j hemipenis. k hemipenis. l end of body. m genitalia. a-c, g-h, j-k: holotype adult male; f, i, m: paratype adult female; l: paratype adult male. Scale: 100μ.

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 485μ | 270μ | RV | 480μ | 270μ |

*Type locality:* Fresh Dip Lake near Robe, S.A. (35°15′42″S, 139°48′42″E).

*Derivation of name:* From Latin *lacustrinus* (= of lakes) as this species, which belongs to a typically estuarine genus, is found in lakes.

*Ecology and distribution:* This truly benthic species has been collected in only four localities near Robe, S.A. apart from the type locality. All localities are characterized by permanent water only slight salinity fluctuations. The salinities were 19 to 28‰. In addition, at the type locality, salinity was 2.8‰. So far, *L. lacustris* has been found in permanent water around 35‰ as no such lakes have yet been sampled in the search for this ostracod. Attempts to find it in the permanent and saline lakes Keilambete and Gnotuk in western Victoria (salinity ca. 55–62‰) were unsuccessful, suggesting that the salinity range of *L. lacustrix* does not reach such values. This species, as for all others in the typical estuarine genus *Lepocythere*, is indicative of permanent water as it does not produce eggs which can withstand desiccation.

*Remarks:* The description of *L. lacustris* corresponds to the specimen identified by Chapman (1919) as *Cythere lubbockiana* from the fossil site at Boneo Swamp. The two rounded tubercles on the posteroventral area of the shell as illustrated by Chapman (1919) on Plate IV.9 are two sand grains which have been removed by me from the specimen in the National Museum of Victoria. The shell architecture of *L. lacustris* varies from almost smooth to coarsely reticulated (Figs 24n,p); at times, reticulation is so thick that the shell has a smooth appearance. Such variations have been mentioned for other estuarine and marine species of *Leptocythere* by Shornikov (1966) and Hartmann & Kuhl (1978). This is not surprising as environmental conditions, such as water salinity in salt lakes, can fluctuate over time.

*L. lacustris* is closely related to *L. hartmanni* (McKenzie 1967). Unfortunately, no males of the latter species have ever been found, as analysis of the hemipenis morphology would have confirmed this distinction. The valves of *L. hartmanni*, however, are not coarsely pitted and reticulation is more sparse (see Hartmann 1979, Pl. III: Figs 3–8). The anterior and posterior grooves are present in both species. The posteroventral notch is much deeper in *L. lacustris* and the smooth posterodorsal hump is absent in *L. hartmanni*.

## FAMILY: LIMNOCYTHERIDAE Sars, 1925
## SUBFAMILY: LIMNOCYTHERINAE Sars, 1925

### **Gomphodella** n.gen.

*Type species: Gomphodella maia* n.sp., gender masculine.

*Diagnosis: Carapace.* Female carapace in dorsal view triangular with greatest width at about 0.66 to 0.75 from anterior; at about 0.4 from anterior, where central muscle field occurs, valves are slightly compressed; absence of prominent lateral ridge in ventral area; sieve pore canals and few broader normal pore canals in row parallel to posterior edge of shell in both valves. Male, in dorsal view, like a flattened oval with both ends pointed.

*Anatomy:* Female maxilla and thoracopodae I and II similar, although of different length; female furca with three stout, pointed and thickly pilose setae.

*Derivation of name:* From a combination of the two names *Gomphocythere* and *Cytheridella* as this genus shares diagnostic features of the two genera.

*Remarks: Gomphodella* is very similar to *Cytheridella* Daday, 1905 except that the shell of the former is less compressed in the area where the central muscle field occurs, and as the maxilla and thoracopodae I and II are similar in *Gomphodella* (in *Cytheridella* the thoracopoda II is transformed into a prehensile palp). The diagnostic feature which *Gomphodella* and *Gomphocythere* Sars, 1924, share is the presence of three stout and thickly pilose setae on the female furca—this is not seen in *Cytheridella*. *Gomphodella* lacks the lateral ventral ridge on both valves on the outside of the shell so typical of *Gomphocythere* species.

*Gomphodella* is to be included in the family Limnocytherinae Sars, 1925, following the recent regrouping of subfamilies in the Limnocytheridae by Colin & Danielopol (1978).

### **Gomphodella maia** n.sp.

FIGS 26–27

*Diagnosis:* Surface of shell pseudopunctate with many sieve pores; posterior area of shell broadly rounded in lateral view; in dorsal view, valves only slightly compressed in female at 0.4 from anterior where central muscle field occurs. Outline of hemipenis as in Fig. 27i.

*Description: Carapace.* (External) Adult: Subrectangular in lateral view with ventrum flat and dorsum arched; posterior broadly rounded and anterodorsal area flatter and forming less steep angle; surface of valves pseudopunctate with many sieve pores; normal pore canals either of simple type or surrounded by rim; a few broader normal pore canals arranged in row parallel to posterior edge of shell in both valves; in dorsal view, carapace of male like flattened oval with anterior end more compressed and pointed and greatest width near middle; in female, greatest width at about 0.75 from anterior which is pointed whereas posterior almost flat except in middle which is slightly convex where both valves meet; at 0.4 from anterior, where central muscle field consisting of row of four vertical scars occurs, valves are slightly compressed in female; left valve slightly longer anteriorly and posteriorly. In some female specimens, occasional faint ridges present ventrally near outer margin of each valve and running parallel to it.

Juvenile: Almost round in lateral view with flattened ventrum; oval in dorsal view; some specimens with broad flange sometimes extending into one or two spines posteroventrally.

(Internal) Inner lamellae much broader anteriorly; selvage prominent and broad all around in both valves; in left valve, however, it is placed further away from edge of valve, especially anteriorly; in front of mouth region, selvages very broad and, when interlocking during valve closure, right selvage placed externally; shell perforated internally; radial pore canals numeroous, short and usually straight. Hinge lophodont: anterior and posterior grooves in right valve elongated and matched by ridges in left valve.

*Anatomy:* Antennula: (Fig. 27a) 6-segmented; length/width ratio of last five segments: 1.9/1, 1.2/1, 0.8/1, 1.2/1, 3/1; longest distal seta bifid with one side more than twice length of other.

Antenna: (Fig. 27b) Three smooth distal claws on terminal segment; pectinate distal claw on inner side of penultimate segment slightly shorter than other three claws.

Mandible: (Figs. 27d,e) Mandibular coxale with seven teeth: inner one slender and twice as long as penultimate; palp with terminal segment almost trapezoid and with two thick distal setae and a shorter and thinner one.

Maxillula: (Fig. 27c) Poorly sclerotized palp with three unequal and broad setae; epipod with 13 long and one small Strahlen.

Maxilla: (Fig. 27f) Distal claw stout, short and curved inward; setae on 1st segment smooth, and distal one on 2nd segment finely pectinated.

Thoracopoda I: (Fig. 27g) Similar to maxilla except for slightly larger size.

Thoracopoda II: (Fig. 27h) Larger than thoracopoda I with distal claw slender, longer and almost straight; inner distal end of last two segments with a short spine.

Hemipenis: Strongly chitinized; for outline see Fig. 27i.

Genitalia: For outline see Figs 27j,k.

Furca: In female (Figs 27j,k) consisting of three short, stout and pointed setae densely covered with stiff hairs and two longer and barren setae; in male (Fig. 27i), two barren setae.

*Colour of shell:* Grey to grey brown.

*Size:*

holotype adult male

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 490μ | 290μ | RV | 460μ | 300μ |

paratype adult female

| | L | H | | L | H |
|---|---|---|---|---|---|
| LV | 560μ | 330μ | RV | 520μ | 320μ |

*Type locality:* Fresh Dip Lake, near Robe, S.A. (35°15′42″S, 139°48′42″E).

*Derivation of name:* From Greek *maia* meaning good mother as some adult females from fossil deposits (Pulbeena and Mowbray Swamp in Tasmania, see De Deckker 1981)[4] were found with juveniles still inside them.

*Ecology and distribution:* This species only occurs in permanent waters as eggs cannot withstand desiccation (for further details, see McKenzie & Hussainy 1969). Brood care certainly occurs for this species as quite a number of female carapaces have been found to yield either one or two juveniles. It is likely to be a freshwater species which can tolerate slight concentrations of dissolved solids in the water as, like *G. australica*, it has been col-

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[4] DE DECKKER, P. (1981) Taxonomy, ecology and palaeoecology of ostracods from Australian inland waters. Ph.D. Thesis, Dept of Zoology, University of Adelaide (unpubl.).

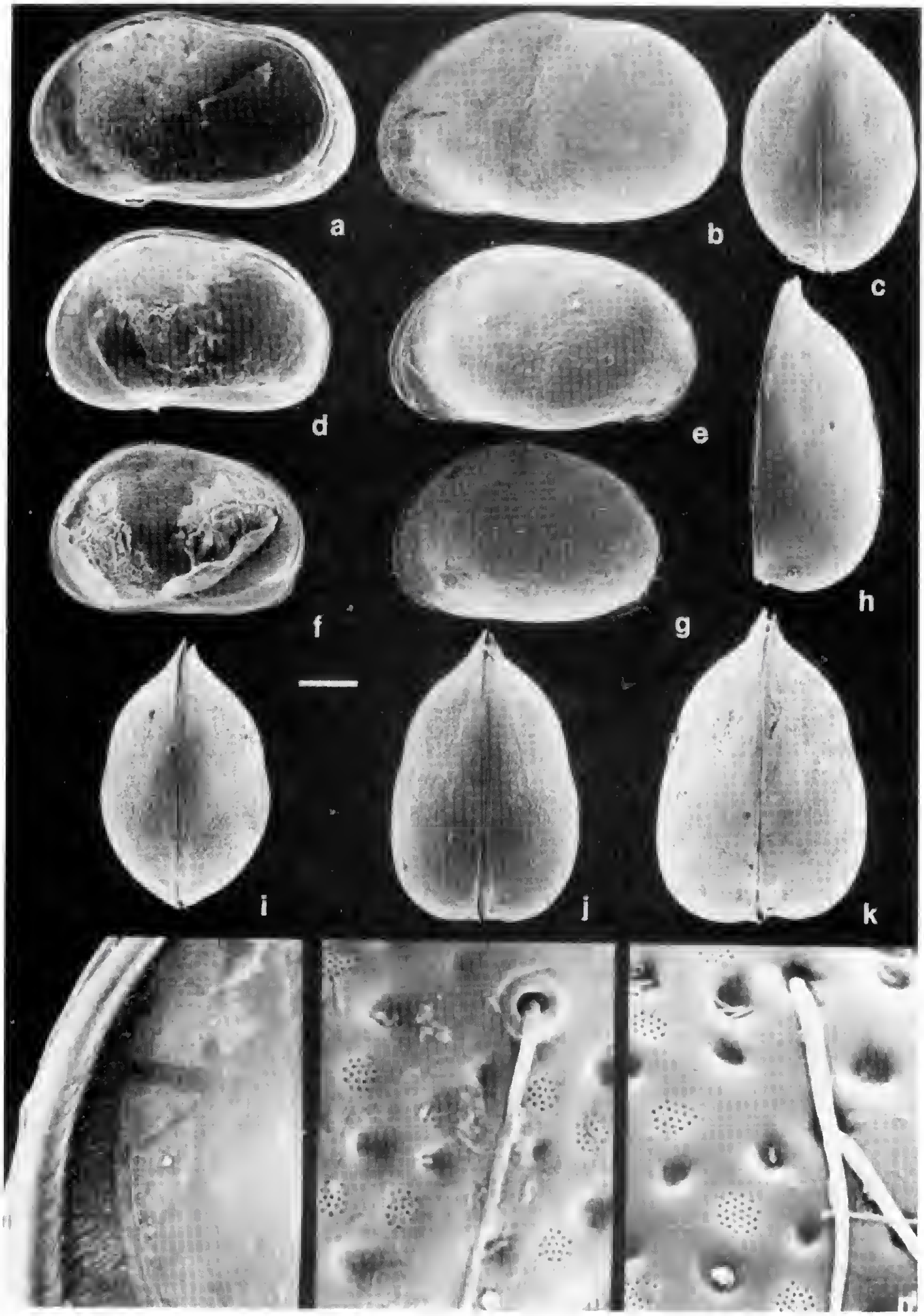

Fig. 26. *Gomphodella maia* n.gen., n.sp. a RV internal, female paratype b LV external, female paratype c C dorsal, male paratype d RV internal, male holotype. e LV external, male holotype. f RV internal, juvenile. g LV external, juvenile. h RV dorsal, female. i C dorsal, male. j C dorsal, female. k C dorsal, female. l RV internal, anterior detail of d. m LV external, detail of e. n LV external, detail of g. a-g, l-n: type locality; h-k: fossil, Blue Lake, Mt Gambier, S.A. Scale: 100μ for a-k; 15μ for l; 5μ for m, n.

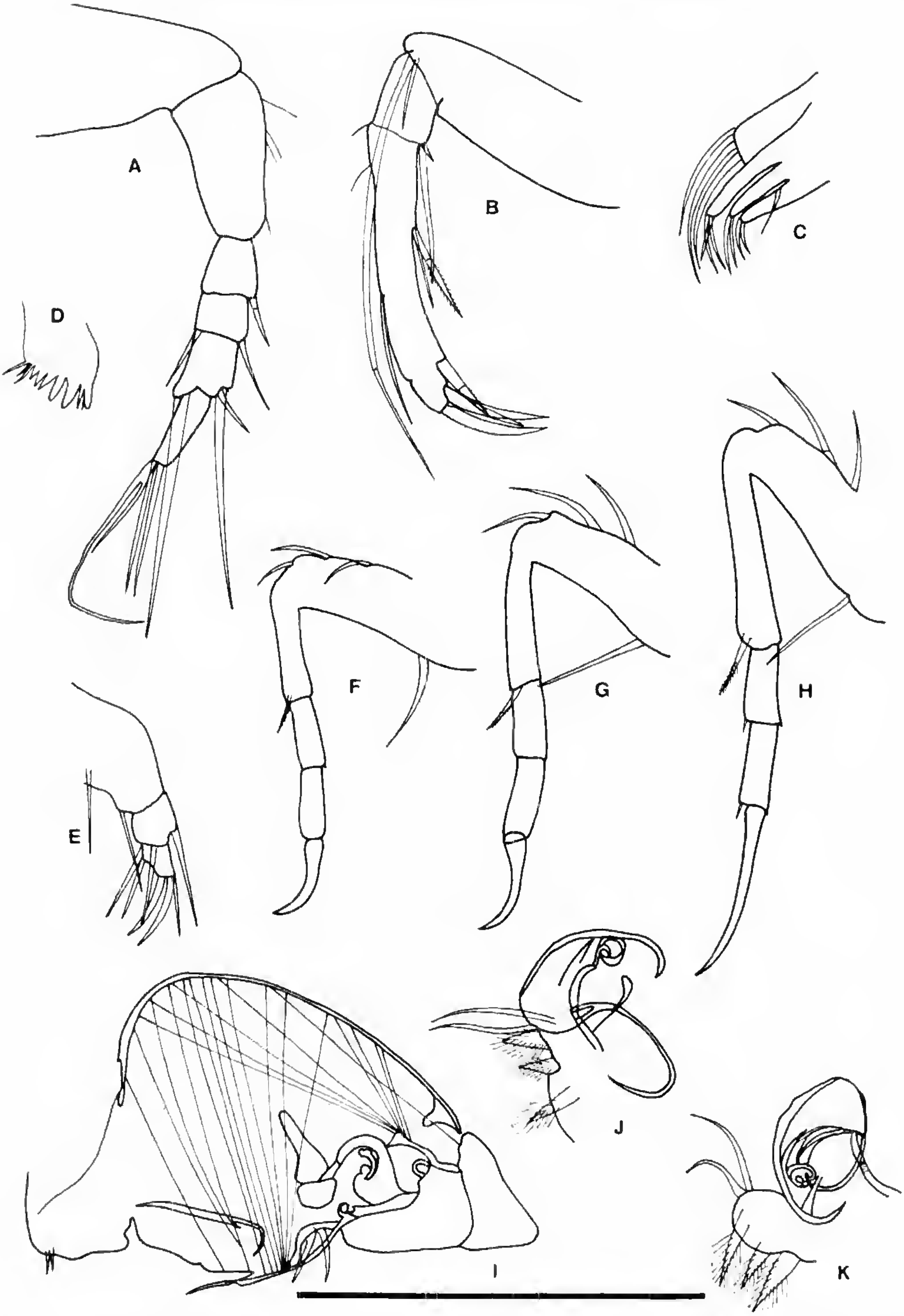

Fig 27. *Gomphodella maia* n.gen., n.sp. a antennula. b antenna c maxillula—palp and lobes. d mandible—coxale. e mandible—palp. f maxilla. g thoracopoda I. h thoracopoda II. i hemipenis and furca. j genital organ and furca. k genital organ and furca. a, c, e, j-k: paratype adult female. b, d, f-i: holotype adult male. Scale: 100μ.

lected alive once in Fresh Dip Lake (= type locality) at 2.3‰ salinity. As a fossil, it has been found with *G. australica*, and other freshwater ostracods in samples from a short core from the Blue Lake at Mt Gambier, S.A. It is also found in two fossil sites in northwestern Tasmania (De Deckker[4]). In samples from both sites, a large number of carapaces were recovered and some of these were found with juveniles inside them. The significance of this phenomenon is not properly understood as, usually, after death under water, valves of ostracods separate prior to or during decay of the soft parts. When ponds dry up, ostracods are seen to close their valves tightly and, if this period is long enough to cause dehydration of the ostracods, death would occur. Rapid sediment accumulation is later necessary during a wet phase to prevent carapaces from opening. This process is likely to be one possible explanation for the high percentage of *G. maia* carapaces found in samples from the two Tasmanian sites. Death caused by changes in water chemistry would not prevent carapaces from dislocation. Another possibility is that *G. maia* can in fact burrow in sediment—a phenomenon noticed for a closely related ostracod *Gomphocybthere* sp. (with another ostracod *Darwinula sphagna* Barclay, 1968) found in the interstitial waters of the Rotorua lakes in New Zealand by Chapman & Lewis (1976)—and, if it was to remain there until death, valves could not become easily dissociated.

### *Gomphodella australica* (Hussainy, 1969)

1969 *Gomphocythere australica* Hussainy, p. 299.

*Diagnosis:* Subrectangular shell with both dorsum and ventrum almost straight; anterior broadly rounded and posteroventral area more pointed with furthest extention of shell at about 0.33 from dorsum; shell ornamentation consisting of faint but broad reticulation especially at anterior and posterior ends. In dorsal view shell in female like an upside down heart and male much narrower with both ends pointed.

*Size range:*

| | L | H |
|---|---|---|
| adult male carapace | 800–900μ | 400–500μ |
| adult female carapace | 650–750μ | 270–320μ |

*Ecology: G. australica* is best known from its type locality, Lake Purrumbete in Victoria. This is a permanent lake with salinity of 0.42–0.50‰ over the 1969–1972 period (Timms 1976) and 0.37–0.44‰ over 1979–80. It is only recorded in that lake (greatest depth > 40m) at 0.5–1 m by Timms (1973)[5]. It is usually found crawling in among filamentous algae like *G. maia*. In South Australia it is also recorded from Scott Creek near Adelaide, and from the permanent Fresh Dip Lake near Robe. *G. australica* is considered to be a freshwater species which can withstand a slight amount of dissolved solids in water, with its highest salinity recorded at Fresh Dip Lake at 2.3‰. Brooding occurs in this species as demonstrated by Hussainy (1969). Fossil specimens, with coarse shell reticulation have been recovered with other fresh water ostracods from a short core taken from the fresh Blue Lake at Mt Gambier, S.A.

*Remarks:* The transfer of this species to *Gomphodella* gen. nov. is necessary because it does not possess the peripheral lateral ridge around the flat base of the shell of each valve so typical of *Gomphocythere* Sars, 1924. This species is easily distinguishable from *G. maia* by its larger size, reticulated shell and the very pointed posterior area of the shell which is also steeply inclined posteroventrally.

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Museum).

I would like to thank Ms S. Lawson and C. Twang for typing the manuscript and Mr P. G. Kempster for help in the photography.

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[5] TIMMS, B. V. (1973) A comparative study of the limnology of three maar lakes in western Victoria. Ph.D. Thesis, Monash University (unpubl.).

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